Samuel McRee,

THE

AMERICAN TUTOR's GUIDE;

BEING

A Compendium of Arithmetic.

IN SIX PARTS.

I. Arithmetic in whole Numbers.
II. Vulgar and Decimal Fractions.
III. Mercantile Arithmetic.
IV. Extraction of Roots, Progressions, Permutation, and Rules for the easy calculation of Interest, Annuities, and Pensions in Arrears, either by Simple or Compound Interest.
V. Duodecimals, or Cross Multiplication, and its application in the Mensuration of Artificers Work, Superfices, Solids, &c.
VI. A collection of Questions.

By JAMES THOMPSON,
Author of a complete Treatise on the Mensuration of Timber.

FIRST EDITION.

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DISTRICT OF NEW-YORK, ss.

(L.S.) BE IT REMEMBERED, That on the Sixteenth day of September, in the Thirty-third year of the Independence of the United States of America, JAMES THOMPSON, of the said District, hath deposited in this Office the Title of a Book, the right whereof he claims as Author, in the words and figures following, to wit: "THE AMERICAN TUTOR's GUIDE; being a Compendium of Arithmetic. In Six Parts. I. Arithmetic in whole Numbers. II. Vulgar and Decimal Fractions. III. Mercantile Arithmetic. IV. Extraction of Roots, Progressions, Permutation, and Rules for the easy Calculation of Interest, Annuities, and Pensions in Arrears, either by Simple or Compound Interest. V. Duodecimals, or Cross-Multiplication, and its application in the Mensuration of Artificers Work, Superfices, Solids, &c. VI. A Collection of Questions. By JAMES THOMPSON, Author of a Complete Treatise on the Mensuration of Timber. *First Edition.*"

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EDWARD DUNSCOMB,
Clerk of the District of New-York.

PREFACE.

AMONG the several branches of *Education* which are taught in Schools, that of Arithmetic is undoubtedly of the greatest importance; and it is either studied by the rich as a necessary part of genteel education, or by those in the middle rank of life, in order to qualify them for their intended pursuits: indeed, the first of these classes may have their ambition fully satisfied by merely studying a system of theory, and the fundamental rules; but the Mechanic, Merchant, Surveyor, Sailor, Soldier, and Engineer, cannot follow his profession to advantage, without being expert in every part of arithmetical computation.

A short, plain and easy course is then to be considered as a desideratum for the use of scholars in every seminary of learning, and it is certainly great encouragement to emulation when the task appears to be short, nor is any thing more discouraging to a beginner than to be impressed with the idea, that the rules to be learned are long and tedious, hence the apparent length of labor and difficult study frequently sets proficiency as it were, at an inaccessible distance, and often does away every hope or wish to excel; the natural desire for learning being thus blasted in the bud, it will be difficult afterwards to induce the scholar to study with ardor.

To learn the rules and solve the examples at school is not enough, but they must be remembered, so as to enable practitioners to perform the calculations not only with ease to themselves, but also to the satisfaction of those who may be interested in their accuracy.

As this compendium has been composed expressly with the intention of answering these ends, it is not designed to *hold out* the expectation of new inventions; but re-

collect and arrange all the useful rules in a convenient practical form, retaining only such parts as have a direct application to the more general purposes in life.

As works of this nature must necessarily be made up of matters that have in a manner become common property, and in a great measure, are contained in some shape or other, in most books of this kind, therefore it will not be imputed to the Author as a crime, that he has availed himself of the materials of some of the best publications on this science, from whence he may have taken extracts, or which he may have imitated.

It is nevertheless expected that something new may be found in this work, and here the Author hopes that he will not be too severely criticised if, through a desire of rendering it short and easy, he has in some instances deviated from the old custom of giving long and tedious rules, particularly in the beginning, where they can be of no avail to the learner unacquainted with the use of figures, but in every part where precepts can be of service either to the scholar in working the questions proposed, or to assist the memory of the teacher in the examination thereof, they will not be found wanting.

The arrangement is such in the Author's opinion, as seems the best calculated for instruction, commencing the practical part with that which is most easy, and by gradual and rising steps proceeding to that which is more complex, in such order that what is prior, paves the way for what is to follow.

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ADVERTISEMENT.

*** *Notwithstanding the great care that has been taken in correcting the press, we are still persuaded that a number of errors have escaped, for which we must crave the indulgence of the public in excusing us from the publication of an* erratum list *to this edition, as our time will not admit of a revisal.*

Explanation of the Characters made use of in this Compendium.

$=$ *Equal.* The sign of Equality; as 112 lb. $=$ 1 cwt. signifies, that 112 lb. are equal to 1 cwt.

$+$ *Plus or more.* The sign of Addition; as $5+5=10$, that is, 5 added to 5 more is equal to 10.

$-$ *Minus or less.* The sign of Subtraction; as $8-2=6$, that is 8 minus 2 is equal to 6.

$\times$ *Multiplied by.* The sign of Multiplication; $4\times7=28$, that is, 4 multiplied by 7 is equal to 28.

$\div$ *Divided by.* The sign of Division; as $28\div7=4$, that is, 28 divided by 7 is equal to 4.

$\frac{4714}{126}$ Numbers placed like a fraction, also denote Division; the upper number being the dividend and the lower the divisor.

: :: : *Proportion.* The sign of Proportion; as 3 : 6 : : 8 : 16, that is, as 3 is to 6, so is 8 to 16.

$7-2+5=10$. Shews that the difference between 2 and 7 added to 5 is equal to 10.

$9-\overline{2\times5}=2$. Signifies that the sum of 2 and 5 taken from 9 is equal to 2.

$\sqrt{}$ or $\sqrt[2]{}$ Prefixed to any number, signifies the Square root of that number is required.

$\sqrt[3]{}$ Signifies the Cube Root is required.

$\sqrt[4]{}$ Denotes the Biquadrate, or Root of the fourth power is required.

$\overline{}$ A Vinculum; denoting the several quantities over which it is drawn, to be considered jointly as a simple quantity.

8^3 The Index or Exponant 3 denotes the third power of 8, or $8^3=512$, that is, 8 multiplied into self three times.

The American Tutor's Guide, &c.

PART I.

Arithmetic in Whole Numbers.

THE INTRODUCTION.

ARITHMETIC is the art of calculating by numbers, and is comprised in the five following fundamental Rules, viz: NUMERATION, ADDITION, SUBTRACTION, MULTIPLICATION and DIVISION.

NUMERATION

Teacheth to read or write any number by these ten characters, 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, and their values differ according to the place they stand in, as may be seen by the following

TABLE.

Hundreds of thousands of millions.	Tens of thousands of millions.	Thousands of millions.	Hundreds of millions.	Tens of millions.	Millions.	Hundreds of thousands.	Tens of thousands.	Thousands.	Hundreds.	Tens.	Units.	
											1	One
										2	1	Twenty-one
									3	2	1	Three hundred and 21
								4	3	2	1	Four thousand 321
							5	4	3	2	1	Fifty-four thousand 321
						6	5	4	3	2	1	Six hundred and 54321
					7	6	5	4	3	2	1	Seven million 654321
				8	7	6	5	4	3	2	1	Eighty-seven milllion 654321
			9	8	7	6	5	4	3	2	1	Nine hundred and 87654321
		8	9	8	7	6	5	4	3	2	1	Eight thousand 987654321
	7	8	9	8	7	6	5	4	3	2	1	Seventy-eight thous. 987654321
6	7	8	9	8	7	6	5	4	3	2	1	Six hundred and 78987654321
Period of thousands of mill.			Period of millions.			Period of thousands.			Period of units.			

TO WRITE NUMBERS.

RULE. Write down the figures as their values are expressed and supply every deficiency in the order with ciphers.

EXAMPLES.

Write down in proper figures the following numbers.

1. Twenty-three. *Ans.* 23
2. Fifty-seven. —
3. One hundred and six. *Ans.*
4. Seven hundred and eighty-nine.
5. Nine thousand three hundred and ten. *Ans.*
6. Six hundred and thirty thousand five hundred and eighty-two. *Ans.*
7. Three million two hundred and sixty thousand, one hundred and five. *Ans.*

To express in words at length any number proposed in figures.

RULE. To the value of each figure, write the name of its place, beginning at the left and reading towards the right.

EXAMPLES.

Write in words the following numbers.

1.	9	*Ans.*	Nine.	6.	35284	*Ans.*
2.	17	—		7.	471805	—
3.	84	—		8.	9178436	—
4.	103	—		9.	12300654	—
5.	4381	—		10.	625847931	—

SIMPLE ADDITION

Teacheth to add two or more sums together, to make one whole or total sum.

EXAMPLES.

(1.)	(2.)	(3.)	(4.)
8	69	876	6768973524
3	78	697	8976254307
5	83	968	6276942578
7	52	543	9757893461
4	87	307	310941375
2	75	219	235483219
6	34	192	4849675261
9	28	374	6975134208
—	—	—	—
—	—	—	—

5. Add 743615; 53742; 6042; 174; 59 and 3 into one sum. *Ans.*

6. Add 567; 4835: 69571; 374625; 8017055 and 47809312 *Ans.*

total sum of 8400041; 5210; 637581294; 95; *Ans.*

QUESTIONS FOR EXERCISE.

8. A merchant is indebted to A. $1205; to B. $738 to C. $71 to D. $19; and to E. $3874. I demand the amount of his debts? *Ans.*

9. A merchant has received the following sums, 811*l.* 517*l.* 243*l.* 13*l.* 185*l.* and 3518*l.* I demand the whole sum. *Ans.*

10. Bought 6 pipes of brandy containing as follows, viz. No. 1. 120; No. 2. 118; No. 3. 125; No. 4. 121; No. 5. 127; and No. 6. 119 gallons. How many gallons in the whole? *Ans.*

11. The difference between two numbers is 307, the lesser is 479. What is the greater number? *Ans.*

12. Add together 3 times 48351; 5 times 87004; 4 times 7482 and 6 times 12345. *Ans.*

13. In the city of Pekin in China, is a bell weighing 120000*lbs.* at Nankin in the same empire, another of 50000*lbs.* and at Erfort in Upper Saxony, the great bell weighs 25400*lbs.* Quere, the weight of the three? *Ans.*

14. The Roman emperor Julius Cæsar, was killed by Brutus, 44 years before Christ, and Louis the XVI. King of France was beheaded, Anno Domini 1793; the distance of time between the events is required? *Ans.*

15. The distance from Portland in the province of Maine to Boston is 125 miles, from Boston to New-York 250, from New-York to Philadelphia 95, from Philadelphia to Baltimore 102, from Baltimore to Richmond in Virginia 176, from Richmond to Charleston, S. Carolina, 540, and from Charleston, to Savannah, in Georgia 119; what is the distance from Portland to Savannah? *Ans.*

16. Money was first made of gold and silver at Argos 894 years before Christ. How many years has it been in use? *Ans.*

SIMPLE SUBTRACTION

Teacheth to take a less number from a greater, and shews the *remainder* or *difference*.

EXAMPLES.

	(1.)	(2.)	(3.)
From	8103	97531	5465768792
Take	5731	46802	2312019876

4. From 65730014 take 24685319.
5. —— 510079137486 —— 374859607182.
6. —— 100000000000 —— 99999999999.

QUESTIONS FOR EXERCISE.

7. *What number added to 853791, will make the sum to be 1035472?* *Ans.*

8. What number subtracted from 2745301 will make the remainder to be 1785392? *Ans.*

9. America was discovered by Columbus in 1492, and its independence declared in 1776. How many years have elapsed between those æres? *Ans.*

10. In the city of Pekin in China, is a bell weighing, it is said, 120000*lbs.* and at Nankin, in the same country, is another weighing 50000*lbs.* the first exceeds the great bell at Erfort, in Upper Saxony, by 94600*lbs.* How much then is the German bell inferior in weight to the second? *Ans.*

11. General George Washington was born in 1732, and died in 1799; what was his age when this event took place and how many years since? *Ans.* his age, and since.

12. A merchant has to receive $817, $512, $601, $21 and $1358; and has to pay rent $150, and his note at the bank for $3352; whither will he have money to borrow or to spare, and how much? *Ans.*

13. You were born 34 years after me; how old shall I be when you are 17? and how old will you be when I am 70 years of age? *Ans.* I shall be and you years.

SIMPLE MULTIPLICATION

Teacheth how to increase the one of two numbers given as often as there are units in the other, and compendiously performs many *additions*.

The number to be multiplied is called the *multiplicand*.

The number by which you multiply is called the *multiplier*.

The number produced by the operation is called the *product*.

Also, the *multiplicand* and *multiplier* are called *factors*.

MULTIPLICATION TABLE.

1	2	3	4	5	6	7	8	9	10	11	12
2	4	6	8	10	12	14	16	18	20	22	24
3	6	9	12	15	18	21	24	27	30	33	36
4	8	12	16	20	24	28	32	36	40	44	48
5	10	15	20	25	30	35	40	45	50	55	60
6	12	18	24	30	36	42	48	54	60	66	72
7	14	21	28	35	42	49	56	63	70	77	84
8	16	24	32	40	48	56	64	72	80	88	96
9	18	27	36	45	54	63	72	81	90	99	108
10	20	30	40	50	60	70	80	90	100	110	120
11	22	33	44	55	66	77	88	99	110	121	132
12	24	36	48	60	72	84	96	108	120	132	144

EXAMPLES.

	(1.)	(2.)	(3.)
Multiplicand	174536	46827	326809
Multiplier	2	3	4
Product	1749072		

4.	Multiply	718374	by 5	8.	Multiply	715602	by 9
5.	——	6500083	— 6	9.	——	2714863	— 10
6.	——	238417	— 7	10.	——	718374	— 11
7.	——	890152	— 8	11.	——	456789	— 12

12.	——	273580961	by 23	Product	6292362103
13.	——	36829157	38	——	1399507966
14.	——	827316	63	——	52120908
15.	——	129186	98	——	12660228
16.	——	181281	763	——	138317403
17.	——	281216	978	——	275029248
18.	——	261986	7638	——	2001049068
19.	——	812617	43859	——	35640569003
20.	——	8496427	874359	——	7428927415293
21.	——	3750	2800	——	10500000
22.	——	627000	268000	——	108036000000
23.	——	89124	60009	——	5348242116
24.	——	1281280	70043	——	89744695040
25.	——	573684	100	——	57368400
26.	——	8475631	10000	——	84756310000
27.	——	8175	99	——	809325
28.	——	72836	9999	——	728287164
29.	——	75643	35	——	2647505
30.	——	63159	49	——	3094791
31.	——	873652	63	——	55040076
32.	——	53746	13	——	
33.	——	64758	15	——	
34.	——	753426	17	——	
35.	——	857463	19	——	
36.	——	68024	102	——	
37.	——	76543	105	——	
38.	——	47135	107	——	
39.	——	83572	21	——	
40.	——	58372	61	——	
41.	——	34567	91	——	

42. Multiply nine million seven thousand nine hundred and sixty by eleven hundred. *Ans.* 9908756000.

43. Multiply eight thousand five hundred and sixteen by seventy-six thousand and two. *Ans.* 647233032.

QUESTIONS FOR EXERCISE.

44. There are two numbers the greater of them is 73 times 109; and their difference 17 times 28. Required their sum and product?

Ans. 15438 their sum. 59526317 their product.

45. What is the product of 7143 multiplied by 37 and 29? *Ans.*

46. There were 71 men concerned in the payment of a sum of money, and each man paid $1275. I demand how much was paid in all? *Ans.*

47. An army of 10000 soldiers having plundered a city, took so much money, that after the Officers took $125000, and the rest was shared among them, each man had $127. Tell me the amount of the sum taken? *Ans.*

SIMPLE DIVISION

Teacheth to find how often one number is contained, in another, and readily performs many *subtractions.*

The number to be divided is called the *dividend*

The number to divide by is called the *divisor.*

The number of times the *dividend* contains the *divisor* is called the *quotient.*

The *remainder*, if any, will be less than the *divisor.*

EXAMPLES.

```
        (1.)                                  (2.)
      dividend.                             dividend.
divisor 6)2184 (364 quotient.   divisor 24)9464 (394 quot.
          18    6                            72    24
          ——   ——                           ——   ——
           38  2184 proof.                   226  1576
           36                                216  788
           ——                                ——      8 rem.
            24                               104  ——
            24                                96  9464 proof.
            ——                               ——
                                              8 remainder.

        (3.)                  (4.)                (5.)
     3)765432(             8)5467421(          11)1234065(
 6.  divide                 89786756   by          17
 7.  ——                     98877665   —           26
 8.  ——                      3257914   —           92
 9.  ——                    749368175   —          271
10.  ——                  83726150493   —         8697
11.  ——                2691219326321 2   —        56789
                         [illegible]3456789876   —      3546572
                         2123456789   —      123456789
```

	(14.)		(15.)
	378|00)57928|39(		765000)93715864(
16.	divide 751849632	by	8570000
17.	—— 493627158	—	1354000
18.	—— 786475	—	100
19.	—— 1230456	—	10000

(20.)	(21.)	(22.)	(23.)
3)56103961	5)1370192	7)837261	9)123456

24. divide 789012 by 11. | 25. divide 5456789 by 12.

RULE. To find the true remainder when the divisor is the product of two numbers, multiply the last remainder by the first divisor, and add the first remainder.

	(26.)			27.	divide	48967	by	72
56	7)31046835			28.	——	89674	—	96
	8) 4435262	1 first rem.		29.	——	93125	—	108
	554407	6 sec. rem.		30.	——	57113	—	99
				31.	——	70421	—	144
				32.	——	48379	—	121
				33.	——	73421	—	132
Ans.	554407	rem. 43.		34.	——	17865	—	180

QUESTIONS FOR EXERCISE.

35. What number multiplied by 72084 will produce 5190048? *Ans.*

36. What number multiplied by 57 will produce just what 134 multiplied by 71 will do? *Ans.*

37. Subtract 30079 out of ninety-three millions as often as it can be found; and say what the last remainder exceeds or falls short of 21180? *Ans.*

38. Suppose nine thousand men march in a column of 750 deep; how many march a breast? *Ans.*

39. I would plant 2072 fruit trees in 14 rows, twenty-five feet assunder; how long must the grove be? *Ans.*

COMPOUND ADDITION

Shews how to add several numbers of different denominations into one sum.

FEDERAL MONEY.

				M.		*C.*			
10 Mills	make	1 Cent.		10	=	1		*D.*	
10 Cents	make	1 Dime.		100	=	10	=	1	$
10 Dimes	make	1 Dollar.		1000	=	100	=	10	= 1
10 Dollars	make	1 Eagle.		10000	=	1000	=	100	= 10

Note—The only division in practical affairs are Dollars and Cents.

English and French crowns at 110 cents, and Spanish dollars at 100 cents, are current in the United States.

EXAMPLES.

1. Add 27½ eagles; 57 dollars, 9 dimes, 4 cents, 5 mills; 171 dollars, 8 cents, 3 mills; 6 eagles, 1 cent, 9 mills; 17 dollars, 2 cents, 4 mills; 12 dollars, 3 dimes and 5 cents, in one sum. *Ans.*

2. What is the sum of 57 E. 7$ 3 d. 4 c. + 14 E. 7$ 5 d. 2 c. + 543$ 5 d. 2 c. + 121$ 9 d. 7 c. + 217$ 1 d. 8 c. into one sum? *Ans.*

3. Add 718$ 54 c. + 159$ 25 c. + 176$ 19 c. + 111$ 67 c. + 912$ 92 c. into one sum. *Ans.*

4. A Cashier received 6 bags of money, the first holds 502$ 10 c. the second 512$ 75 c. the third 1004$ the fourth 895$ 95 c. the fifth 599$ 50 c. and the sixth holds 998$. I demand the sum received? *Ans.*

ENGLISH MONEY.

			qrs.		*d.*			
4 Farthings	make	1 Penny.	4	=	1	=	*s.*	
12 Pence	make	1 Shilling.	48	=	12	=	1	£.
20 Shillings	make	1 Pound Sterling.	960	=	240	=	20	= 1

Likewise in this manner was money reckoned in the several States, until Congress passed a law in favor of the decimal computation.

Guineas of 21*s*. half guineas of 10*s*. 6*d*. crowns of 5*s*. half crowns of 2*s*. 6*d*. shillings, sixpences, pence, half pence, and farthings are the real coins of Great Britain.

PENCE TABLE.

Pence Table.			Pence Table.			Shillings Table.			
d.	*s.*	*d.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
20 is	1	8	130 is	10	10	1 is	12	12 is	144
30 —	2	6	140 —	11	8	2 —	24	13 —	156
40 —	3	4	150 —	12	6	3 —	36	14 —	168
50 —	4	2	160 —	13	4	4 —	48	15 —	180
60 —	5	0	170 —	14	2	5 —	60	16 —	192
70 —	5	10	180 —	15	0	6 —	72	17 —	204
80 —	6	8	190 —	15	10	7 —	84	18 —	216
90 —	7	6	200 —	16	8	8 —	96	19 —	228
100 —	8	4	210 —	17	6	9 —	108	20 —	240
110 —	9	2	220 —	18	4	10 —	120		
120 —	10	0	230 —	19	2	11 —	132		

(5.)

£.	s.	d.	q.
342	12	6	1
176	18	1	2
293	14	5	1
187	10	4	3
310	17	9	0
471	11	7	4

(6.)

£.	s.	d.
18	2	4½
17	10	8¼
10	17	2
11	11	11½
16	18	6½
11	1	6

(7.)

£.	s.	d.
7	4	3
8	0	1¼
18	1	10½
1	19	11¾
2	12	6
4	14	6

TROY WEIGHT.

			gr.	dwt.	oz.	℔.
24 Grains	make	1 Penny weight.	24 =	1		
20 Penny weights	make	1 Ounce.	480 =	20 =	1	
12 Ounces	make	1 Pound.	5760 =	240 =	12 =	1

By this weight are weighed Gold, Silver, and Jewels.

(8.)

Oz.	dwt.	gr.
7	11	15
4	16	11
9	10	21
7	17	13
5	15	19
8	19	23

(9.)

Oz.	dwt.	gr.
9	14	16
7	17	17
8	15	14
5	19	23
6	12	11
4	18	20

(10.)

℔.	oz.	dwt.	gr.
7	10	15	11
5	11	13	21
3	11	19	20
1	9	11	19
6	1	17	18
4	7	14	23

(11.)

℔.	oz.	dwt.
1	11	13
7	10	15
2	7	17
8	6	19
3	5	14
9	4	16

APOTHECARIES' WEIGHT.

			gr.	℈.	ʒ.	℥.	℔
20 Grains	make	1 Scruple.	20 =	1			
3 Scruples	make	1 Dram.	60 =	3 =	1		
8 Drams	make	1 Ounce.	480 =	24 =	8 =	1	
12 Ounces	make	1 Pound	5760 =	288 =	96 =	12 =	1

By this weight Apothecaries' compound their medicines; but they buy and sell by Avoirdupois weight.

(12.)

℔.	℥.	ʒ.	℈.	gr.
3	11	7	2	21
7	10	1	1	23
8	8	6	0	19
9	7	4	0	20
8	4	5	1	18
5	5	3	2	11

(13.)

℔.	℥.	ʒ.	℈.	gr.
10	5	7	2	20
9	8	6	0	19
8	10	5	2	18
7	11	4	2	17
6	11	3	2	16
5	11	2	2	15

(14.)

℔.	℥.	ʒ.	℈.	℔
8	11	7	2	19
7	10	7	2	20
6	10	6	1	18
5	10	6	1	18
4	10	7	1	18
3	11	7	1	11

AVOIRDUPOIS WEIGHT.

			dr.	oz.				
16 Drams	make	1 Ounce.	16–	1	lb.			
16 Ounces		1 Pound.	256–	16–	1	qr.		
28 Pounds		1 Quarter	7168–	448–	28–	1	cwt.	
4 Quarters		1 Hund. wt.	28672–	1792–	112–	4–	1	ton.
20 Hund. wt.		1 Ton.	573440–	35840–	2240–	80–	20–	1

By this weight are weighed all coarse and drossy goods, groceries and chandlery wares, also all metals, except gold and silver.

The pound Avoirdupois is equal to 14oz. 11 dwt. 15½gr. Troy.

(15.)			(16.)			(17.)					
cwt.	qrs.	lb.	lb.	oz.	dr.	ton.	cwt.	qrs.	lb.	oz.	dr.
15	3	27	13	14	15	13	16	3	25	14	13
17	1	25	17	10	11	15	10	2	24	15	13
19	0	23	10	12	14	16	10	2	23	11	12
18	0	21	12	13	11	11	12	1	23	11	14
18	1	20	19	11	11	11	12	0	27	10	15
18	1	21	18	8	4	10	11	1	26	10	15
19	2	22	11	15	15	11	11	1	26	14	10

LONG MEASURE.

			in.	ft.				
3 Bar. Corns	make	1 Inch.						
12 Inches		1 Foot.	12-	1	yd.			
3 Feet		1 Yard.	36-	3-	1	per.		
5½ Yards		1 Pole or Per.	198-	16½	5½	1	fur.	
40 Perches		1 Furlong.	7920-	660-	220-	40-	1	m
8 Furlongs		1 Mile.	63360-	5280-	1760-	320-	8-	1
3 Miles		1 League.	190080-	15840-	5280-	960-	24-	3
69½ Amer. or 60 Geo. Miles		1 Degree.						
360 Degrees		1 great circle of the globe.						

By this they measure the distance of places, or any thing where length is considered without any regard to breadth.

(18.)			(19.)				(20.)							
m.	fur.	per.	yds.	f.	in.	b. c.	lea.	m.	fur.	per.	yd.	ft.	in.	b. c.
2	7	37	17	1	10	2	11	2	6	36	4	2	11	2
1	6	31	13	2	8	0	12	1	7	32	5	2	10	1
2	5	35	10	2	11	0	13	1	7	33	4	1	10	1
2	5	35	12	1	9	1	15	0	5	31	2	0	9	2
1	7	39	12	1	10	1	10	1	2	12	1	1	7	2
0	7	39	13	2	10	1	10	1	3	10	3	2	2	1
		20	12	0	11	2	10	1	4	7	3	1	1	0

CLOTH MEASURE.

			in.		na.					
2¼ Inches	make	1 Nail.	2¼	=	1		qr.			
4 Nails		1 Quarter.	9	=	4	=	1	F. E.		
3 Quarters		1 Ell Flem.	27	=	12	=	3	=	1	yd.
4 Quarters		1 Yard.	36	=	16	=	4	=	1	ell.
5 Quarters		1 Ell Eng.	45	=	20	=	5	=	1¼	= 1 F.E.
6 Quarters		1 French E.	54	=	24	=	6	=	1½	= 1

(21.)

yds.	qrs.	na.
184	1	3
175	3	3
179	3	2
181	3	2
192	0	3
191	2	0
178	0	1

(22.)

ells.	qrs.	na.
134	4	2
137	2	3
141	3	0
142	2	3
140	2	2
139	4	3
128	4	1

(23.)

ells flem.	qrs.	na.
1338	2	3
1541	2	3
1485	0	2
1270	0	2
1385	2	2
1299	2	3
1399	2	3

LAND MEASURE.

			sq. inch.		sq. ft.					
144 Sq. In.	make	1 Sq. Ft.	144-		1	sq. yd.				
9 Sq. feet		1 Sq. yd.	1296-		9-	1	sq. pl.			
30¼ Sq. yds		1 Sq. po.	39204-		272¼	30¼	1	rd.		
40 Sq. poles		1 Rood.	1568160-		10890-	1210-	40	- 1	ac.	
4 Roods		1 Acre.	6272640-		43560-	4840-	160	- 4	- 1	

By this they measure every thing, where length and breadth are considered, without regard to thickness.

(24.)

acres.	r.	p.
875	3	37
758	2	27
587	3	17
857	3	27
785	2	31
578	1	23

(25.)

pol.	feet.	in.
35	178	142
17	261	107
23	162	113
32	95	121
43	194	119
32	172	105

(26.)

acres.	r.	pol.	yds.	ft.	in.
765	2	35	29	7	139
756	3	36	28	8	129
675	3	32	27	6	121
668	0	10	21	0	101
814	1	11	17	5	113
959	3	39	30	8	143

SOLID MEASURE.

			in.		ft.	
1728 Inches	make	1 Foot.	1728	=	1	yd.
27 Feet		1 Yard.	46656	=	27	= 1
40 Feet of round } Timber.		1 Tun.				
50 Feet of hewn } Timber.						

128 Solid Feet, i. e. 8 in length, 4 in breadth, and 4 make a cord of wood or bark.

(27.)			(28.)			(29.)		
ton.	*feet.*	*inches.*	*yds.*	*feet.*	*inches.*	*cord.*	*feet.*	*inches.*
31	37	1357	93	25	1235	39	119	1104
43	32	1012	71	13	721	37	112	1345
37	11	1213	83	24	1019	41	103	1234
21	21	940	79	19	1117	35	111	1098
19	12	1005	80	21	1311	20	123	1103

DRY MEASURE.

		pts.	*gals.*					
2 Pints	1 Quart.	8=	1	*pec.*				
2 Quarts	1 Pottle	16=	2=	1	*bu.*			
2 Pottles	1 Gallon	64=	8=	4=	1	*qr.*		
2 Gal.	1 Peck.	512=	64=	32=	8=	1	*wey.*	
4 Pecks	1 Bush-	2560=	320=	160=	40=	5=	1	*last.*
8 Bush.	1 Quar.	5120=	640=	320=	80=	10=	2=	1
5 Quar.	1 Weigh or load.							
2 Weys	1 Last.							

make

Thirty-six bushels make a chaldron.

By this are measured, Corn, Seeds, Roots, Fruits, Salt, Coals, Oysters, &c.

The Corn or Winchester Bushel 2150 2-5 solid inches, the Dimensions by Statute to be 8 inches deep, and 18½ inches in diameter.

But the Coal bushel must be 19½ inches in diameter.

(30.)			(31.)			(32.)				(33.)			
ch.	*bu.*	*p.*	*qrs.*	*bu.*	*p.*	*bus.*	*p.*	*qt.*	*pt.*	*last.*	*qrs.*	*bu.*	*p.*
19	28	3	73	7	3	358	3	7	1	3	7	6	2
17	30	3	39	1	2	281	2	3	0	7	6	5	3
15	19	0	31	1	2	174	1	6	0	8	7	4	0
16	10	0	30	1	2	145	2	5	1	5	2	1	2
18	15	1	29	2	3	172	0	3	1	2	5	5	2
12	14	2	27	5	1	190	0	6	1	7	4	3	1

ALE AND BEER MEASURE.

		pts.	*qts.*				
2 Pints	1 Quart.	2-	1	*gal.*			
4 Quarts	1 Gallon.	8-	4-	1	*bar.*		
32 Quarts	1 Bar. Ale.	256-	128-	32-	1	*Ale.*	*hhd.*
36 Gallons	1 Bar. Beer.	288-	144-	36-	1	*Beer*	
54 Gallons	1 Hogshead.	432-	216-	54-	1½-	1	*butt.*
2 Barrels	1 Puncheon.	864-	432-	108-	3 -	2-	1 *tun.*
2 Hhds.	1 Butt.	1728-	864-	216-	6 -	4-	2- 1
2 Butts	1 Tun.						

make

Note.—Besides the above, there are other denominations, viz: the firkin of ale in London, 8 gallons, and of beer 9 gallons, but in all other parts of England for ale and beer 8½ gallons is a firkin, and 4 firkins make a barrel. 1 gal.=282 solid inches.

(34.)

hhd.	*gal.*	*qts.*
579	53	3
123	1	2
215	17	0
324	19	3
241	13	1
412	11	3

(35.)

A-bar.	*gal.*	*qts.*	*pt.*
29	31	3	0
12	17	0	1
17	12	1	1
13	15	2	0
19	13	2	1
18	18	1	1

(36.)

butt.	*bar.*	*gal.*	*qts.*	*pts.*
51	2	35	3	1
49	0	31	3	1
49	0	29	3	1
49	1	00	1	0
48	2	35	3	1
49	1	10	1	0

WINE MEASURE.

2 Pints	make	1 Quart	*pts.*	*qts.*					
4 Quarts		1 Gallon.	2–	1	*gal.*				
10 Gallons		1 Anchor.	8–	4–	1 *tier.*				
18 Gallons		1 Runlet.	336–	168–	42–1	*hhd.*			
31½ Gallons		1 Barrel.	504–	252–	63–1½	–1	*pun.*		
42 Gallons		1 Tierce.	672–	336–	84–2	–1½	–1	*pipe.*	
63 Gallons		1 Hhd.	1008–	504–	126–3	–2	–1½	–1	*tun.*
84 Gallons		1 Punch.	2016–	1008–	252–6	–4	–3	–2	–1
2 Hogsheads		1 Pipe or Butt.							
2 Pipes		1 Tun.							

Note.—By this are measured Wine, Spirits, Cider, Vinegar, Oil, Honey, Mead, Perry, &c.

The Wine Gallon contains 231 solid inches, and is in the same proportion to the Ale Gallon of 282 solid inches, as the pound Troy is to the pound Avoirdupois.

(37.)

tierces.	*gal.*	*qts.*	*pts.*
53	41	3	1
50	31	3	1
50	37	0	1
49	31	2	0
48	11	2	1
46	15	2	1

(38.)

hhd.	*gal.*	*qts.*
16	62	3
11	50	3
17	31	0
19	42	1
29	43	1
10	45	2

(39.)

T.	*hhd.*	*gal.*	*qts.*	*pts.*
2	3	61	3	1
7	2	45	2	0
9	2	49	2	1
5	2	37	2	1
8	3	53	1	0
6	1	52	1	1

OF TIME.

			sec.	min.				
60 Sec.	make	1 Min.	60-	1-	hr.			
60 Min.		1 Hour.	3600-	60-	1-	day.		
24 Hours		1 Day.	86400-	1440-	24-	1	wk.	
7 Days.		1 Week.	604800-	10080-	168-	7-	1	mo.
4 Weeks		1 Month.	2419200-	40320-	672-	28-	4	1
13 Months		1 Year.						year.
365¼ Days		1 Year.	31557600-	525960-	8766-	365¼-		1

To know the days in each month.

RULE.—Thirty days hath September,
April, June, and November:
February hath twenty-eight alone,
All the rest have thirty and one;
Except in Leap-year, and then's the time,
February's days are twenty and nine.

(40.)					(41.)			(42.)						
W.	d.	h.	m.	s.	Y.	m.	d.	Y.	m.	w.	d.	h.	m.	s.
13	6	21	56	47	17	10	21	46	11	3	6	23	37	48
10	5	13	50	45	18	11	18	37	10	2	4	18	25	51
12	2	10	41	45	15	8	23	42	8	1	5	19	56	54
11	4	16	40	12	10	9	20	49	9	0	2	21	50	53
9	3	17	45	30	16	7	16	37	4	2	3	20	45	30
5	1	19	48	59	13	4	19	25	10	2	5	22	12	15

MOTION.

			"	'				
60 Seconds	make	1 Minute.	60=	1	°			
60 Minutes		1 Degree.	3600=	60=	1	s.		
30 Degrees		1 Sign.	108000=	1800=	30=	1		
12 Signs		1 Circle.	1296000=	21600=	360=	12=		Zodiac.

(43.)			(44.)				(45.)				
°	'	"	°	'	"	"'	s.	°	'	"	"'
83	27	49	71	51	46	30	5	23	53	47	57
72	51	45	82	27	57	45	2	10	25	50	30
65	29	59	93	32	41	15	4	17	30	25	15
37	47	52	60	35	10	32	7	12	48	32	19
51	32	56	42	12	45	48	3	15	45	30	21
67	38	41	64	17	32	40	6	26	41	23	31

QUESTIONS FOR EXERCISE.

46. Paid at the Bank this week, viz: On Monday, $763.45; *Tuesday,* $6.375; on Wednesday, $571.125; on Thurs-

day, $119.50; on Friday, $105.625; and on Saturday, $684.875. How much did the whole amount to? *Ans.*

47. Paid several bills as follows, viz: To Adam Bell, £.97 14 6½; to James Dee, £.7 0 7½; to Geo. Mason, £.18 17 9; to Peter Watts, £.23 8 5½; and to Thomas Munn, £.9 15 0. How much was paid in all? *Ans.*

48. A Merchant, upon the balance of his accounts, finds himself indebted, viz: to A. three hundred and seven pounds; to B. seven hundred pounds, eight shillings and seven pence; to C. fifteen hundred and nine pounds, eighteen shillings and six pence; to D. twelve hundred and fourteen pounds, five shillings and nine pence; to E. seven hundred and ninety-seven pounds, sixteen shillings and three pence, and to F. four hundred and eleven pounds, two shillings and ten pence. What doth the whole amount to? *Ans.*

49. Entered in the Custom-House, 6 Hogsheads Jamaica Sugar, each weighing neat as follows, viz: No. 1. 10 *cwt.* 3 *qrs.* 27 *lbs.*; No. 2. 11 *cwt.* 2 *qrs.* 16 *lbs.*; No. 3. 13 *cwt.* 2 *qrs.* 21 *lbs.*; No. 4. 13 *cwt.* 3 *qrs.* 14 *lbs.*; No. 5. 12 *cwt.* 3 *qrs.* 7 *lbs.*; No. 6. 13 *cwt.* 3 *qrs.* 19 *lbs.* I demand the quantity entered. *Ans.*

50. A Manor contains as follows, viz: Mr. S——'s farm, 179 *acres*, 3 *r.* 17 *p.*; the Common, 427 *acres*, 1 *r.* 18 *p.*; Arable land, 47 *acres*, 2 *r.*; Mr. J——s field, 37 *acres*, 3 *r.* 36 *p.*; Meadows, 153 *acres*, 1 *r.* 13 *p.*; Pasture, 149 *acres*, 2 *r.* 17 *p.* How many Acres does this Manor contain? *Ans.*

COMPOUND SUBTRACTION

Teacheth to find the difference between any two sums of divers denominations.

FEDERAL MONEY.

EXAMPLES.

	(1.)					(2.)					(3.)			(4.)			
	E.	$.	*d.*	*c.*	*m.*	$.	*d.*	*c.*	*m.*		$.	*c.*		$.	*c.*	*m.*	
From	87	6	9	4	5	8347	9	2	0		532	25		764	21	0	
Take	54	7	8	7	5	7483	7	4	5		341	55		456	87	5	
Rem.																	

ENGLISH MONEY.

	(5.)			(6.)			(7.)		
	£.	*s.*	*d.*	£.	*s.*	*d.*	£.	*s.*	*d.*
From	784	13	9½	8472	10	4	345	7	3½
Take	576	15	6	2185	16	10½	123	13	8¼
Rem.									

TROY WEIGHT.

	(8.)			(9.)			(10.)			
	oz.	*dwt.*	*gr.*	*lb.*	*oz.*	*dwt.*	*lb.*	*oz.*	*dwt.*	*gr.*
From	7	11	15	151	9	13	120	7	12	15
Take	3	10	12	136	9	17	97	11	15	22
Rem.										

APOTHECARIES' WEIGHT.

	(11.)			(12.)					(13.)				
	℔.	℥.	ʒ.	℔.	℥.	ʒ.	℈.	*grs.*	℔.	℥.	ʒ.	℈.	*grs.*
From	31	11	5	10	5	7	1	18	94	3	7	0	10
Take	20	10	6	7	8	6	2	21	57	5	6	1	13
Rem.													

AVOIRDUPOIS WEIGHT.

	(14.)				(15.)			(16.)					
	ton.	*cwt.*	*qrs.*	*lb.*	*lb.*	*oz.*	*dr.*	*ton.*	*cwt.*	*qrs.*	*lb.*	*oz.*	*dr.*
From	5	11	2	14	14	13	12	15	12	2	15	13	10
Take	2	13	3	21	10	14	15	10	15	2	27	15	12
Rem.													

LONG MEASURE.

	(17.)			(18.)					(19.)						
	miles.	*fur.*	*per.*	*yds.*	*ft.*	*in.*	*b.c.*	*lea.*	*m.*	*fur.*	*per.*	*yd.*	*ft.*	*in.*	*b.c.*
From	57	5	28	18	1	7	1	13	2	3	17	4	1	10	0
Take	38	7	41	13	2	6	2	10	2	6	31	4	2	10	1
Rem.															

CLOTH MEASURE.

	(20.)			(21.)			(22.)			(23.)			
	yds.	*qrs.*	*na.*	*ells.*	*qrs.*	*na.*	*ells.*	*fl.*	*qrs.*	*na.*	*yds.*	*qrs.*	*na.*	*in.*
From	173	2	2	78	3	2	197	1	1		123	2	1	2
Take	140	3	2	35	3	3	108	2	3		119	3	2	1¾
Rem.														

LAND MEASURE.

	(24.)			(25.)			(26.)					
	acres.	*r.*	*pol.*	*pol.*	*ft.*	*in.*	*acres.*	*r.*	*pol.*	*yds.*	*ft.*	*in.*
From	875	1	15	29	132	141	63	1	31	27	6	123
Take	765	2	25	22	159	142	47	3	29	28	7	134
Rem.												

SOLID MEASURE.

	(27.)			(28.)			(29.)		
	ton.	*feet.*	*in.*	*yds.*	*ft.*	*in.*	*cord.*	*feet.*	*in.*
From	31	37	1234	93	23	1025	37	119	1107
Take	23	36	1537	75	24	1451	29	121	1345
Rem.									

DRY MEASURE.

	(30.)			(31.)			(32.)					
	ch.	*bu.*	*p.*	*qrs.*	*bu.*	*p.*	*last.*	*qrs.*	*bu.*	*p.*	*qt.*	*pt.*
From	119	21	1	183	2	2	15	2	1	2	3	0
Take	107	23	3	151	3	3	10	6	5	3	7	1
Rem.												

ALE AND BEER MEASURE.

	(33.)			(34.)			(35.)					
	hhd.	*gal.*	*qt.*	*bar.*	*gal.*	*qt.*	*butt.*	*bar.*	*gal.*	*qt.*	*pt.*	
From	57	49	2	28	30	2	50	2	30	2	0	
Take	38	52	3	21	31	3	29	2	32	3	1	
Rem.												

WINE MEASURE.

	(36.)			(37.)			(38.)					
	tier.	*gal.*	*qts.*	*hhd.*	*gal.*	*qts.*	*tun.*	*hhd.*	*gal.*	*qts.*	*pt.*	
From	52	40	2	36	21	2	5	2	37	1	0	
Take	45	41	3	19	52	3	3	2	59	2	1	
Rem.												

TIME.

	(39.)				(40.)			(41.)						
	w.	*d.*	*h.*	*m.*	*y.*	*m.*	*d.*	*y.*	*m.*	*w.*	*d.*	*h.*	*m.*	*s.*
From	50	2	13	40	19	10	20	46	9	2	3	20	31	19
Take	31	6	20	51	11	10	23	31	10	2	5	21	39	41
Rem.														

MOTION.

	(42.)			(43.)			(44.)				
	°	′	″	°	′	″	s.	°	′	″	‴
From	31	23	15	187	15	30	7	18	35	40	15
Take	29	27	45	158	30	45	3	27	48	59	55
Rem.											

QUESTIONS FOR EXERCISE.

45. If I borrow from a friend, five thousand eight hundred and fifty-three dollars, and pay him three thousand nine hundred and ninety-seven dollars, eighty-seven cents, and five mills; what am I yet indebted to him? *Ans.*

46. Yesterday I had seven eagles, three half eagles, twelve dollars, and five French crowns in my purse, and paid several small debts to the amount of twenty-nine dollars, thirty-seven cents and five mills; but by curiosity, I passed through a crowd to know what was the matter, where I lost my purse and money. How much cash did I loose? *Ans.*

47. A merchant failing, owed to A. £. 317 13*s.* 10½*d.*; to B. £. 375; to C. £. 107 18*s.* 9*d.*; to D. £. 271 16*s.* 5*d.*; and to E. £. 517 10*s.* 6½*d.* His effects at that time were as follows, viz: In cash, £. 210 14*s.* 4½*d.*; in goods, £. 397 15*s.* 6½*d.*; in household furniture, £. 191 7*s.* 9*d.*; and in book debts, £. 295 12*s.* 8*d.* What will his creditors loose? *Ans.*

48. A merchant has 209 casks of butter, weighing 395 *cwt.* 2 *qrs.* 21 *lb.*; ships off 170 casks of the said butter, weighing 321 *cwt.* 3 *qrs.* 7 *lb.* I demand the number of casks he has left and their weight? *Ans.* *casks, weighing*

49. A shop-keeper bought 42 yards of fine cloth, for £ 90, of which he sells 27 yards for £. 63. I demand the quantity left, and what it stands him in? *Ans.*

50. A grocer buys ninety-five hundred weight, three quarters, and nine pounds of refined sugar; and sells out forty-ni[illegible]d weight, and half a hundred weight, and twenty-[illegible] Required the quantity remaining on hand? *Ans.*

COMPOUND MULTIPLICATION.

RULE.—Multiply the lowest denomination by the quantity given, and find how many of the next higher is contained therein, which add to the product of the next higher denomination, setting down the remainder under its proper name. When the given quantity is above 12, multiply by any two or more numbers, which multiplied together, will make the quantity; but if no two or more numbers will produce the given quantity, then multiply the top line by as many as is wanting, or over, which add to or subtract from the last product.

EXAMPLES.

	(1.)			(2.)			(3.)			(4.)		
	£	c.	m.	£	c.	m.	£	c.	m.	£	c.	m.
Mult.	16	18	6	27	6	5	21	73	7	35	41	7
By			3			5			7			9

	£.	s.	d.		£.	s.	d.
5. Multiply	7	10	3 by 2	11. Multiply	18	12	7 by 8.
6. Multiply	10	19	11 by 3	12. Multiply	17	11	5 by 9.
7. Multiply	13	1	8½ by 4	13. Multiply	16	10	4 by 10.
8. Multiply	11	11	5¼ by 5	14. Multiply	15	9	3 by 11.
9. Multiply	11	19	1¾ by 6	15. Multiply	14	8	2¾ by 11.
10. Multiply	12	0	10½ by 7	16. Multiply	13	7	1½ by 12.

17. 3 yards at 13*s.* 7*d.* } *Per yard &c.*
18. 5 cwt. at 37*s.* 4*d.* } *Per yard &c.*
19. 7 stone at 21*s.* 7½*d.* } *Per yard &c.*

20. 8 gall. at 18*s.* 9*d.* } *Per gallon &c.*
21. 10 ells at 4*s.* 10½*d* } *Per gallon &c.*
22. 12 days at 7*s.* 9*d.* } *Per gallon &c.*

N. B. For the better understanding of Compound Multiplication, let the scholar be made well acquainted with the following questions.

23. What will ½lb. of tea cost at 17*s.* 9*d* per lb.?
Ans. 8*s.* 10½*d.*

24. What will ¼ bushel of wheat cost at 13*s.* 6*d.* per bushel?
Ans. 3*s.* 4½*d.*

25. What will ¾ cwt. of sugar cost at £13 50 c. per cwt.?
Ans. £10 12½ c.

26. What will ⅞ yard of cloth cost at 46*s.* 10*d.* per yard?
Ans. 40*s.* 11¾*d.*

27. What will 132 lb. of loaf sugar cost at 22 c. 5 m. per lb.?
Ans. £29 70 c.

28. What will 32 cwt. at £14 62½ c. per cwt. cost? *Ans.* £

29. What will 44 gallons at 12*s.* 4½*d.* pergallon, cost?
Ans. £. 27 4 6.

30. What will 60lb. tea cost at 5*s.* 7¼d per lb.?
Ans. £.16 18 9.

Questions.	*Answers.*
31. 108 bushels at 17*s.* 10*d.* per bushel?	£. 96 6 0
32. 29 gallons of wine at $1 12½ c. per gallon?	$ 32 62½ c.
33. 123 yards at 35*s.* 3*d.* per yard?	£. 216 15 9
34. 140½ bushels at 17*s.* 2*d.* per bushel?	£. 120 7 7½
35. 57½ bushels at 17*s.* 10½*d.* per bushel?	£. 51 7 9¾
36. 112¾ bushels at $2 17 c. per bushel?	$ 244 66¼ c.
37. 357 yards at 4*s.* 7½*d.* per yard?	£. 82 11 1½
38. 624 bushels at 12*s.* 8*d.* per bushel?	£. 395 4 0
39. 473 bushels at $1 60 c. per bushel?	$
40. 512 bushels at 15*s.* 10*d.* per bushel?	£. 405 6 8
41. 483 gallons at 11*s.* 5*d.* per gallon?	£. 275 14 3
42. 364 gallons at 5*s.* 8½*d.* per gallon?	£. 103 17 10

When the quantity does not exceed 240, nor the price 12 pence, then, by the pence table, find what it comes to at one penny per yard, &c. Multiply this sum by the pence in the price, and the product will give the answer.

43. What will 116 lb. cost at 7¾*d.* per lb.?

	£.	*s.*	*d.*	
116 pence =	0	8	8	the price at 1*d.* per lb.
			7	
	3	0	8	the price at 7*d.* per lb.
Half of 8*s.* 8*d.* =	0	4	4	the price at ½*d.* per lb.
Half of 4*s.* 4*d.* =	0	2	2	the price at ¼*d.* per lb.
Answer.	£ 3	7	2	the price at 7¾*d.* per lb.

Questions.	*Answers.*
44. 149 yards at 10¾*d.* per yard?	£. 6 13 5¾
45. 230 yards at 11¼*d.* per yard?	£. 10 15 7½
46. 150½ dozen at 5½*d.* per dozen.	£. 3 8 11¾

To find the value of a hundred weight, by having the price of 1 lb. Set down 2*s.* 4*d.* and multiply it by the farthings in the price of 1 lb. or 9*s.* 4*d.* multiplied by the pence in the price of 1 lb. The product will give the answer.

47. What will 1 cwt. of Chalk amount to at 2¼*d.* per lb.?

	£.	*s.*	*d.*	
112 farthings =	0	2	4	the price of 1 cwt. at ¼*d.* per lb.
			9	farthings in the price of 1 lb.
Answer.	£. 1	1	0	price of 1 cwt. at 2¼*d.* per lb.

Questions.	*Answers.*
48. 1 cwt. of Iron at 4¾*d.* per lb.?	£. 2 4 4
49. 1 cwt. of Cheese at 7*d.* per lb.?	£. 3 5 4
50. 1 cwt. of ——— 6¼*d.* per. lb.?	£. 2 18 4

To find the value of any number of hundred weights, by having the price of one pound, first find the value of one cwt. and multiply that value by the number of cwts.

51. What is the value of 5 cwt. 2 qrs. 14 lb. of Pork at 6½*d.* per lb.? *Ans.* £.17 1*s.* 3*d.*

Questions.	*Answers.*
52. 7 cwt. of beef at 4¾*d.* per lb?	£.15 10 4
53. 8½ ——— at 5*d.* per lb?	£.19 16 8
54. 6¼ ——— at 7*d.* per lb.?	£.20 8 4

To find the value of a hundred weight at any price per pound. Multiply the price of 1 lb. by 8, its product by 7, and this product by 2; which will produce the answer required.

Questions.	*Answers.*
55. 1 cwt. of cinnamon at 17*s.* 3*d.* per lb.?	£.96 12 0
56. 1 cwt. of tea at 14*s.* 2¾*d.* per lb.?	£.79 13 8
57. 1 cwt. of —— at $3 14 c.?	$ 351 68 c.
58. 1 cwt. of indigo at $2 83 c.	$

QUESTIONS FOR EXERCISE.

59 What is the weight of 7 hogsheads of Sugar, each weighing 13 cwt. 1 qr. 19 lb. *Ans.*

60. A gentleman is possessed of 12 silver table spoons, each weighing 2 oz. 14 dwt.; 18 tea ditto, each weighing 14½ dwt.; 2 silver cans, each 13 oz. 17 dwt.; and a tankard 23 oz. 13 dwt. Pray what is the weight of the whole? *Ans.*

61. If a gentleman spend daily $2 82 c. and at the years end lays up $765. What is his yearly income? *Ans.*

62. Suppose a gentleman's income is $1666 67 c. a year, and he expends daily $3 32 c. What doth he lay up at the years end? *Ans.*

63. A merchant dying left his widow £. 1780, and £. 1250 to each of his 4 children; £. 31 10*s.* a piece to 15 of his poor relations, and £. 150 to charities; he had been 25½ years in trade, and at an average had cleared £. 126 a year. What had he to begin with? *Ans.*

64. In the partition of lands in a certain settlement, A. had 1217 acres, 1 r. 32 per. allotted to him; B. had 2715 acres, 3 r. 17 per.; C. 15962 acres, 12 per.; D. 2005 acres, 2. r. 9 per.; E. 17698 acres, 2 r.; F. 37649 acres; and G. 19073 acres, 1 r. 27 per. How many acres did the settlement contain, since the allotments made as above, want 173 acres, 3 per. of being one sixth part of the whole?

Ans.

COMPOUND DIVISION.

RULE.—Divide the first denomination on the left hand, and if any remains, multiply them by as many of the next less as make one of that, which add to the next, and divide as before.

EXAMPLES.

(1.)

	$	c.
5)	48	75
	$ 9	75

(2.)

	$	c.	m.
7)	135	71	5

(3)

	$	c.
9)	73	81

4.

	$	c.
11)	345	05

5.

	£	s.	d.
4)	47	12	6

6.

	£	s.	d.
6)	73	0	3

7.

	£	s.	d.
8)	19	11	10

8.

	£	s.	d.
10)	8	17	4¾

9.

	£	s.	d.
12)	14	15	7½

10.

	lb.	oz.	dwt.	grs.
5)	17	10	13	20

11.

	lb.	℥	ʒ	℈	grs.
7)	27	9	7	1	14

12.

	tons.	cwt.	qrs.	lb.	oz.
9)	15	13	2	18	10

13.

	m.	fur.	per.	yds.
8)	15	6	21	3

14.

	yds.	qrs.	na.
9)	12	1	3

15.

	acres.	ro.	per.
10)	107	2	37

16.

	days.	ho.	m.
11)	12	15	11

17.

	cord.	ft.	in.
9)	35	119	1005

18.

	cha.	bu.	p.
9)	191	18	1

19.

	hhd.	gal.	qt.
12)	54	48	2

20.

	°	′	″
12)	30	21	19

21. If 11 yards of linen cost £. 2 0*s*. 4*d*. what is it per yard? *Ans.*

22. If 8 cwt. cost $111, what is the price of 1 cwt? *Ans.*

23. If 9 sheep cost £.7 3*s*. how much did 1 cost? *Ans.*

24. If 72 lb. of tea cost £.45, what is it per lb.? *Ans.*

25. If 84 swine cost £.253 13*s*. how much is it per piece? *Ans.*

26. If 108 bushels of wheat cost £96 6*s*. what cost 1 bushel? *Ans.*

27. If 1 cwt. of cheese cost £3 3*s*. what is that per lb.? *Ans.*

28. At £3 10*s*. per cwt. what will 1 lb. cost? *Ans.*

29. At $4 20 c. per cwt. what is the price of 1 lb? *Ans.*

30. At £12 12*s*. per cwt. what cost 1 lb? *Ans.*

31. If 3 cwt. of cheese cost £10 10*s*. what is that per lb. *Ans.*

32. If 2¾ cwt. of butter cost £14 2*s*. 4*d*. what is it per lb.? *Ans.*

33. If 7½ cwt. of bacon cost £28, what is the price per. lb.? *Ans.*

34. If 5 cwt. of loaf sugar cost $128 80 c. what is it per lb? *Ans.*

Note—If there be ¼, ½ or ¾ of a yard, lb, &c. multiply both the quantity and price by 4, then work according to the rule.

35. If 140¼ yards broadcloth cost £300 19*s*. 0¾*d*. what cost 1 yard? *Ans.* £2 2*s*. 11.

36. If 82 yards of linen cost £15 10*s*. 11*d*. what cost 1 yard? *Ans.*

37. If 519 yards of check cost $275 7 c. what cost 1 yard? *Ans.*

38. If 73½ gallons of rum cost £28 9*s*. 7½*d*. what cost 1 gallon? *Ans.*

39. If 35 sheep cost $78 75 c. what are they a piece? *Ans.*

QUESTIONS FOR EXERCISE.

40. My purse and money quoth Dick, are worth $4 50 c. but the money is worth eleven times the purse. Pray what sum did it contain? *Ans.*

41. Divide $14003, among 2948 men? *Ans.*

42. A dealer bought two lots of snuff, that together weighed 9 cwt. 3 qrs. 16 lb. for £97 17*s*. 6*d*. their difference in point of weight, was 1 cwt. 2 qrs. 16 lb. and of price £8 13*s*. 3*d*. Their respective weights and values are required?

Ans. { Greater weight, 5 cwt. 3 qrs. 2 lb. price £53 5*s*. 4½*d*.
{ Lesser weight, 4 cwt. 0 qrs. 14 lb. price £44 12*s*. 1½*d*

43. A cubic foot of water weighs 76 lbs. Troy; and the air is 860 times lighter than water. I demand the weight of a cubic foot of air? *Ans.* 1 *oz*. 1 *dwt*. 5 *gr*.

44. If 43 cwt. 2 qrs. 8 lb. of tobacco be made up into 5 equal hogsheads, what will be the neat weight of a hogshead? *Ans.*

45. A privateer takes a prize worth £2851 4*s*. of which the captain gets 1-16; each of 6 officers 1-32 of the remainder, and the private men, being 45 in number, get the rest equally divided among them. What is each man's share?

Ans. { Captain's share £178 4*s*.
Each officer's share, £83 10*s*. 7½*d*.
Each private man's share £58 5*s*. 3*d*.

46. A general of an army distributes £15 19*s*. 2½*d*. among 4 captains, 5 lieutenants, and 60 common soldiers, in the manner following: Every captain is to have 3 times as much as a lieutenant, and every lieutenant twice as much as a common soldier. I demand their several shares.

Ans. { Captain's share 20*s*. 4½*d*.
Lieutenant's share 6*s*. 9½*d*.
Common soldier's 3*s*. 4¾*d*.

REDUCTION

Is the changing of numbers from one name or denomination to another, without altering their value.

1st. Great names are brought to small by *Multiplication*, and is called *Reduction Descending*.

2d. Small names are brought to great by *Division*, and is called *Reduction Ascending*.

Reduction Descending and Ascending prove each other.

TABLE I.

Shewing the weight and value of Federal Coins *as they pass in the United States.*

	Names of the Coins.	*Old standard weight.*		*federal value.*	*N. Hamp. Ver. Massa. Rh. Isl. Conn. & Virga.*			*New-York and N. Carolina.*			*N. Jersey, Penn. Delaware & Maryland.*			*South Carolina and Georgia.*		
		Dwts.	*Grs.*	$ *C.*	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*
Gold.	Eagle	11	6	10 00	3	0	0	4	0	0	3	15	0	2	6	8
	½ Eagle	5	15	5 00	1	10	0	2	0	0	1	17	6	1	3	4
	¼ Eagle	2	19½	2 50	0	15	0	1	0	0	0	18	9	0	11	8
Silver.	Dollar	17	8	1 00	0	6	0	0	8	0	0	7	6	0	4	8
	½ Dollar	8	16	0 50	0	3	0	0	4	0	0	3	9	0	2	4
	¼ Dollar	4	8	0 25	0	1	6	0	2	0	0	1	10½	0	1	2
	Dime	1	17⅗	0 10	0	0	7⅕	0	0	9⅗	0	0	9	0	0	5⅖
	½ Dime	0	20⅘	0 05	0	0	3⅗	0	0	4⅘	0	0	4½	0	0	2⅘
	Cent	[illegible]		0 01	0	0	0⅖	0	0	0⅖	0	0	0 9/10	0	0	0 4/10
				00½	0	0	0 2/25	0	0	0 1/25	0	0	0 1/20	0	0	0 1/20

The standard of Gold Coins is 11 parts fine, to 1 part alloy; the alloy to be silver and copper mixed, not exceeding one half silver. The standard of Silver Coins is 1485 parts fine to 179 parts alloy, all copper.

TABLE II.

Shewing the weight and value of Foreign Coins *as they pass in the United States.*

	Names of the Coins.	Old standard weight.		federal value.		N. Hamp. Ver. Massa. Rh. Isl. Conn. & Virga.			New-York and N. Carolina.			N. Jersey, Penn. Delaware & Maryland.			South Carolina and Georgia.		
		Dwts.	Grs.	$ c. m.		£.	s.	d.	£.	s.	d.	£.	s.	d.	£.	s.	d.
Gold.	Johannes,	18	0	16	00 0	4	16	0	6	8	0	6	0	0	3	14	8
	Doubloon	16	21	14	78 1	4	8	8¾	5	18	3	5	10	10½	3	8	11¾
	Moidore,	6	18	6	00 0	1	16	0	2	8	0	2	5	0	1	8	0
	E. Guinea	5	6	4	66 7	1	8	0	1	17	4	1	15	0	1	1	9½
	F. Guinea	5	5	4	56 2	1	7	4½	1	16	6	1	14	2½	1	1	3½
Silver.	E.&F.Cro.	19		1	10 0	0	6	7½	0	8	9¾	0	8	3	0	5	1½
	Sp. Dollar	17	6	1	00 0	0	6	0	0	8	0	0	7	6	0	4	8
	Pistareen	3	11		20 0	0	1	2⅖	0	1	7⅕		1	6	0	0	11⅕

By Act of Congress, February 9th, 1793, the Gold Coins of Great-Britain and Portugal, were made legal tenders at the rate of 27 grains per Federal Dollar; and those of France and Spain at 27⅖ grains per Dollar.

TABLE III.

MISCELLANEOUS.

200 lb.	make a barrel of beef or pork.	
196 lb.	—	— flour.
100 lb.	—	— gun-powder.
112 lb.	—	quintal of fish.
120 lb.	—	seam of glass.
16 lb.	—	stone of feathers, cheese or butter.
14 lb.	—	— wool, iron, shot or horseman's wt.
8 lb.	—	— butchers meat.
7½ lb.	—	gallon of oil.
19½ cwt.	—	fodder of lead.
6 feet	—	fathom.
4 inch.	—	hand.
20 art.	—	score.
5 score	—	short hundred.
6 do.	—	long do.

12 articles make a dozen.
5 dozen — roll of parchment.
12 do. — small gross.
12 gross or 144 dozen, make a great gross.
24 sheets make a quire of paper.
20 quires — ream do.

I. *To reduce a number of a higher denomination to that of a lower.*

RULE—Multiply the greatest denomination by the number of the next less, as will make one of the greater, adding in said less denomination, if any, &c.

II. *To reduce a number of a lower denomination to a higher.*

RULE—Divide the given denomination by that number which makes one of the next higher, and so on till the highest name is arrived at, each remainder, if any, will be the name of the dividend.

EXAMPLES.

1. In $725, how many cents? *Ans.* 72500 *c.*
2. In 72500 cents, how many dollars? — $725.
3. In $79 84 cents, how many cents? — 7984 *c.*
4. In 7984 cents, how many dollars? — $79 84 *c.*
5. In £27, how many shillings & pence? — 540*s.* 6480*d.*
6. In 6480*d.* how many shil. and pounds? — 540*s.* £27.
7. In £40 10*s.* how many farthings? — 38880 *qrs.*
8. In 38880 farthings, how many pounds? — £40 10*s.*
9. In $586, how many pence N. Y. currency? *Ans.* 56256*d.*
10. In 56256*d.* N. Y. currency, how many dols? — $586.
11. In 21 guineas, how many pence sterling? — 5292*d.*
12. In 5292*d.* sterling, how many guineas? — 21*g.*
13. In 24 lb. of silver, how many oz. dwts. and grs? *Ans.* 288 *oz.* 5760 *dwts.* 138240 *grs.*
14. In 138240 grs. how many dwts. oz. and lb? *Ans.* 5760 *dwts.* 288 *oz.* 24 *lb.*
15. In 12 lb. 10 oz. 22 grs. how many grains? *Ans.* 73942 *grs.*
16. In 73942 grains, how many pounds? *Ans.* 12 *lb.* 10 *oz.* 22 *grs.*
17. In 14 lb. how many ounces, drams, scruples and grains? *Ans.* 168 ℥. 1344 ʒ. 4032 ℈. 80640 *grs.*
18. In 80640 grs. how many ℈. ʒ. ℥. and lb? *Ans.* 4032 ℈. 1344 ʒ. 168 ℥. 14 *lb.*
19. In 4 lb. 11 ℥. 2 ℈. 17 grs. how many grains? *Ans.* 28377 *grs.*
20. In 28377 grains how many pounds? *Ans.* 4 *lb.* 11 ℥ 0 ʒ. 2 ℈. 17 *grs.*

Note—There are some sorts of silk which are weighed by f 24 oz.

21. In 1 ton, how many qrs. lb. oz. and drs ?
Ans. 80 *qrs.* 2240 *lb.* 35840 *oz.* 573440 *drs.*
22. In 573440 drs. how many oz. lb. qrs. and cwt ?
Ans. 35840. *oz* 2240 *lb.* 80 *qrs.* 20 *cwt.*
23. In 461 great pounds of silk, how many oz. and drs ?
Ans. 11064 *oz.* 177024 *drs.*
24. In 177024 drs. how many oz. and great lb ?
Ans. 11064 *oz.* 461 *great lb.*
25. In 12 tons, 10 cwt. 14 lb. 11 oz. 15 drs. how many drs ?
Ans. 7171775 *drs.*
26. In 7171775 drs. how many tons ?
Ans. 12 *tons,* 10 *cwt.* 14 *lb.* 11 *oz.* 15 *drs.*
27. In 176 miles, 30 poles, how many poles ? *Ans.* 56350 *po.*
28. In 56350 poles, how many miles ? *Ans.* 176 *m.* 30 *po.*
29. In 12 leagues, 1 mile, 6 feet, 29 poles, 4 yards, how many barley corns ? *Ans.* 7193178 *b. c.*
30. In 7193178 barley corns, how many leagues ?
Ans. 12 *l.* 1 *m.* 6 *f.* 29 *p.* 4 *yds.*
31. In 24 yards, how many qrs. and nails ? *Ans.* 96 *qrs.* 384 *na.*
32. In 384 nails, how many qrs. and yds ? *Ans.* 96 *qrs.* 24 *yds.*
33. In 72 ells, Eng. 4 qrs. 2 nails, how many na ? *Ans.* 1458 *na.*
34. In 1458 nails, how many ells, Eng ? *Ans.* 72 *el. E.* 4 *qrs.* 2 *n.*
35. In 121 ells, Flemish, how many nails ? *Ans.* 1452 *na.*
36. In 1452 nails, how many ells, Flemish ? — 121 *el. F.*
37. In 42 acres, how many roods, and poles ? —168 *r.* 6720 *p.*
38. In 6720 poles, how many acres ? — 42 *ac.*
39. In 12 acres, 3 roods, 29 p. how many poles ? — 2069 *p.*
40. In 2069 poles, how many acres ? —12 *a.* 3 *r.* 29 *p.*
41. In 15 tons of hewn timber, how many solid inches ?
Ans. 1296000 *in.*
42. In 1296000 cubic inches of hewn timber, how many tons ?
Ans. 15 *tons.*
43. In 5 cords of wood, how many solid inches ?
Ans. 1105920 *in.*
44. In 1105920 solid inches, how many cords of wood ?
Ans. 5 *cords.*
45. In 24 quarters of corn, how many quarts ? — 6144 *qts.*
46. In 6144 quarts, how many quarters ? — 24 *qrs.*
47. In 36 cha. 26 bu. of coals, how many pecks ? — 5288 *pecks.*
48. In 5288 pecks, how many chaldrons ? — 36 *ch.* 26 *bu.*
49. In 12 bar. of ale, how many gal. and qts ? —384 *g.* 1536 *qts.*
50. In 1536 quarts of ale, how many barrels ? — 12 *bar.*
51. In 6 hogsheads, 27 gallons, 6 pints of ale, how many pints ? *Ans.* 2526 *pts.*
52. In 2526 pints of ale, how many hhds ? —6 *hhds.* 27 *g.*
53. In 6 tuns, 1 butt, 42 gallons of beer, how many quar
Ans. 57

54. In 5784 quarts of beer, how many tuns? — 6 *t.* 1 *b.* 42 *g.*
55. In 4 anchors of brandy, how many gallons and quarts? *Ans.* 40 *gal.* 160 *qts.*
56. In 160 quarts, how many anchors? — 4 *anch.*
57. In 42 tierces, 24 gallons, how many pints? *Ans.* 14304 *pts.*
58. In 14304 pints, how many tierces? *Ans.* 42 *tier.* 24 *gal.*
59. In 4 tuns, 1 pipe, 1 hogshead, 42 gallons, 6 pints, how many pints? *Ans.* 9918 *pts.*
60 In 9918 pints, how many tuns? *Ans.* 4 *tun,* 1 *p.* 1 *hhd.* 42 *gal.* 6 *pts.*
61. In 428 weeks, 4 days, 15 hours, how many hours? *Ans.* 72015 *ho.*
62. In 72015 hours, how many weeks? — 428 *w.* 4 *d.* 15 *ho.*
63. In 15 years, 19 days 21 hours, 37 minutes, 45 seconds, how many seconds? *Ans.* 475047465 *sec.*
64. In 475047465 seconds, how many years? *Ans.* 15 *y.* 19 *d.* 21 *h.* 37 *m.* 45 *s.*
65. In 6 signs of the Zodiac, how many seconds? *Ans.* 648000 *sec.*
66. In 648000 seconds, how many degrees? — 180 *de.*

III. *To reduce foreign coins and the state currencies to Federal Money.*

RULE—Reduce the foreign coin, or currency, to the lowest denomination mentioned either in the question, or in the value of a dollar, then divide by as many of that denomination as make a dollar.

IV. *To reduce Federal Money to the coin, or currency of any other state.*

RULE.—Reduce the dollars to the lowest denomination mentioned either in the value of a dollar, or in one piece of the coin, &c. then divide by as many of that denomination as make one piece of the coin, &c.

EXAMPLES.

67. In £3757, New-York currency, how many dollars? *Ans.* $9392 50 *c.*
68. In $9392, 50 cents, how many pounds New-York currency? *Ans.* £3757.
69. In £349, 19*s.* 1*d.* New-England currency, how many dollars? *Ans.* $1166 51⅓ *c.*
70. In $1166 51⅓ cents, how many pounds New-England currency? *Ans.* £349 19*s.* 1*d.*
71. In £100, New-Jersey currency, how many dollars? *Ans.* $266 66⅔ *c.*
72. ⅔ cents, how many pounds New-Jersey cur- *Ans.* £100.

73. In £140, South-Carolina currency, how many dollars? *Ans.* $600.

74. In $600, how many pounds South-Carolina currency? *Ans.* £140.

Note.—*In Canada, &c. the Federal Dollar is 5s.*

75. In £225, Canada currency, how many dols? *Ans.* $900.

76. In $900, how many pounds Canada currency? *Ans.* £225.

Note.—*In England, the Federal Dollar is 4s. 6d.*

77. In £375 sterling, how many dollars? *Ans.* $1666 66⅔ c.

78. In $1666 66⅔ c. how many pounds ster? — £375.

79. In 100 English guineas, how many dols? — $466 66⅔ c.

80. In $466 66⅔ cents, how many E. Guineas? — 100 *g.*

81. In 183 moidores, how many dollars? — $1098.

82. In $1098, how many moidores? — 183 *m.*

QUESTIONS FOR EXERCISE.

83. In £107 10*s.* 8*d.* how many two-pences? *Ans.* 12904.

84. In 5348 two-pences, how many pounds? — £44 11*s.* 4*d.*

85. In £6 17*s.* how many three-pences? — 548.

86. In 2782 three-pences, how many pounds? — £34 15*s.* 6*d.*

87. In £10 10*s* 8*d.* how many four-pences? — 263.

88. In 3859 four-pences, how many pounds? — £64 6*s.* 4*d.*

89. In £200 17*s.* how many six-pences? — 8034.

90. In 795 six-pences, how many pounds? — £19 17*s.* 6*d.*

91. In £30 sterling, how many crowns & pence? — 120*c.* 7200*d.*

92. In 20160 pence, how many half crowns, crowns and pounds sterling? *Ans.* 672 *half crs.* 336 *crs.* £84.

93. In £25, how many shillings, 5 shilling pieces and pence? *Ans.* 500*s.* 100 *crs.* 6000*d.*

94. In 80 pieces of 5 shillings, how many shillings and pounds? *Ans.* 400*s.* £20.

95. In £213 15*s.* 6*d.* ster. how many crowns, half crowns and shil. and of each an equal number? *Ans.* 503 *of each.*

96. In 36 crowns, as many half crowns, shillings, and four-pences, how many pounds sterling? *Ans.* £15 18*s.*

97. In 21 purses, each purse 21 guineas, a crown and a moidore, what sterling do they contain? *Ans.* £496 13*s.*

98. In 21424 qrs. how many pieces each of 5*s.* of 2*s.* 6*d.* of 1*s.* and of 1*d*? *Ans.* 52.

99. In 4 ingots of silver, each 4 lb. 6 oz. 22 grains, how many grains? *Ans.* 103768 *g.*

100. In 241056 grains, how many ingots, each 6 lb. 11 oz. 14 dwts? *Ans.* 6 *ing.*

101. A lady sent a tankard to her silversmith, that weighed 50 oz. 8 dwt. and ordered it to be made into spoons, each to weigh 2 oz. 16 dwt. how many each? *Ans.* 18.

102. A goldsmith having 16 ingots of silver, each weighing 2 lb. 4 oz. which he made into bowls of 2 lb. 8 oz. tankards of 1 lb. 6 oz. salts of 10 oz. 10 dwt. and spoons of 1 oz. 18 dwt. and of each an equal number. Quere, that number? *Ans.* 7 *of each*, 224 *dwt. over.*

103. In 7 ℥. 5 ʒ. 2 ℈. 15 grs. of ipecacuanha, how many doses of 16 grs. each, after deducting for waste 19 grains? *Ans.* 231.

104. In 264 drams of metal, how many weights of ½ gr. 1 gr. 2 grs. 4 grs. 5 grs. 10 grs. 1 ℈. 2 ℈. 1 ʒ. 2 ʒ. 4 ʒ. 1 ℥. and of each an equal number? *Ans.* 16 *of each*, 120 *grs. over.*

105. In 12880 lb. of sugar, how many hhds. each 11½ cwt? *Ans.* 10.

106. In 507 cwt. of lead, how many fodder? — 26.

107. In 12 cwt. 3 qrs. 12 lb. of tea, how many canisters of 12 lb. each can be filled? *Ans.* 120.

108. In 1 hhd. of sugar, weighing net 8¾ cwt. how many parcels, each 126½ lb. *Ans.* 7 *parcels*, 94½ *lb. over.*

109. In 2 tierces of tobacco, each weighing net 4 cwt. 3 qrs. 24 lb. how many parcels of 6 lb. 8 lb. 12 lb. and 16 lb. and of each an equal number? *Ans.* 26 *of each*, 20 *lb. over.*

110. In 7 cwt. 3 qrs. 17 lb. of gun-powder, how many cartridges of 3 pound each? *Ans.* 295.

To reduce great pounds into common, × *by* 3, *and* ÷ *by* 2.

To reduce common pounds to great, × *by* 2, *and* ÷ *by* 3.

111. In 547 great pounds, how many common lb? *Ans.* 820½.

112. In 552 common pounds, how many great lb? — 368.

113. In 16 miles, how many feet, inches and barley corns? *Ans.* 844 *ft.* 1013760 *in.* 3041280 *b. c.*

114. In 2280060 barley corns, how many miles? *Ans.* 11 *m.* 7 *f.* 38 *p.*

115. How many barley corns will reach round the terraqueous globe, which is 360 degrees, and each degree 69½ miles? *Ans.* 4755801600.

116. In running 150 miles, required the number of revolutions a wheel 18 feet 4 inches will make? *Ans.* 43200.

117. In 21600 turns of a measuring wheel 18 feet, 4 inches in circumference, how many miles? *Ans.* 75.

118. In 30 ells, English, 4 quarters, 3 nails, how many nails? *Ans.* 619.

119. In 569 nails, how many ells, Flemish? *Ans.* 47 *e.F.* 1 *q.* 1 *n.*

120. In 12 pieces of cloth, each 20 ells, Flemish, how many ells English? *Ans.* 144.

121. [illegible]25 yards of cloth, how many bales of 25 pieces, [illegible]d each piece 15 ells, English? *Ans.* 12.

122. In 64 acres of land, how many roods and poles?
Ans. 256 *r.* 10240 *p.*
123. In 21760 poles, how many acres? — 136.
124. In a field of 774 acres, how many shares of 270 perches each? *Ans.* 458 and 180 *poles over.*
125. A farmer rents a plantation of 200 acres, of which he is to till no more than 96½ acres, how many poles are there in the remainder? *Ans.* 16560.
126. In a log of timber that is 1½ feet square, and 16 in length, how many solid inches and feet?
Ans. 62208 *in.* 36 *ft.*
127. In 317520 solid inches, how many cubic feet?
Ans. 183 *ft.* 9 *in.*
128. In 24 quarters of wheat, how many pecks and gallons?
Ans. 768 *pecks,* 1536 *gal.*
129. In 3360 gallons of corn, how many quarters?
Ans. 52 *qrs.* 4 *bu.*
130. In 40 chaldron of coals, how many bushels and pecks?
Ans. 1440 *bu.* 5760 *pks.*
131. In 4762 bushels, how many chaldron of coals?
Ans. 132 *ch.* 10 *bu.*
132. In 12 barrels of ale, how many gallons and pints?
Ans. 384 *gal.* 3072 *pts.*
133. In 1704 pints of ale, how many barrels?
Ans. 6 *bar.* 21 *gal.*
134. In 6 barrels, 2 firkins, 7 gallons of beer, how many gallons? *Ans.* 241.
135. In 4 tuns, 1 butt, 1 hhd. 49 gallons of beer, how many hhd. barrels and firkins, and of each an equal number?
Ans. 10 *of each, and* 85 *gal. over.*
136. In 12 tierces of wine, how many gallons and pints?
Ans. 504 *gal.* 4032 *pts.*
137. 6048 pints, how many tierces? *Ans.* 18.
138. In a tun of wine, how many quarts, pints and half pints, and of each an equal number? *Ans.* 576.
139. In 1890 gallons of wine, how many pipes, puncheons, hogsheads and tierces, and of each an equal number?
Ans. 6.
140. In a lunar month, or 27 days, 7 hours, 43 minutes, 5 seconds, how many seconds? *Ans.* 2360585 *sec.*
141. How many days is it since the birth of our Saviour to Christmas, 1808, allowing the year to be 365 days 6 hours? *Ans.* 660824.
142. In 17 score, how many dozens? — 28 *doz. and* 4.
143. In 5¼ long hundreds, how many scores, dozens, and half dozens, and of each an equal number? *Ans.* 30.

THE RULE OF THREE DIRECT.

The Rule of Three Direct teaches by having three numbers given to find a fourth, which shall bear such proportion to the second as the third doth to the first; and is that in which more requires more, or less requires less.

RULE.—State the question by making that number which asks, the third term; that which is of the same name or quality as the first term; and that which is of the same name or quality with the answer required, the second term. Then multiply the second and third terms together, and divide the product by the first. The quotient will be the fourth term or answer, in the same name or denomination as the second term was left in.

Note—The first term is always known by the words *if*, or *at*; and the third term is also known by the words *how much*, or *what will*.

EXAMPLES.

1. If 4 lb. of tobacco 75 c. what will 28 lb. cost at that rate?

lb.	*cts.*	*lb.*	$ *cts.*	
4 :	75 : :	28 :	5 25	*the answer.*

2. If 75 cents buy 4 lb. of tobacco, how much will $5 25 c. buy? *Ans.* 28 *lb.*

3. If 28 lb. of tobacco cost $5 25 cents, how much can I buy for 75 cents? *Ans.* 4 *lb.*

4. Suppose $5¼ will buy 28 lb. of tobacco, what will 4 lb. of the same tobacco cost? *Ans.* 75 *cents.*

5. If 19 dozen pair of stockings cost £76 19*s.* what cost 1 pair? *Ans.* 6*s.* 9*d.*

6. If 1 pair of stockings cost 6*s.* 9*d.* what cost 19 dozen pair? *Ans.* £76 19*s.*

7. What is the price of 239 eggs, when they are rated at 15 for a shilling? *Ans.* 15*s.* 11$\frac{3}{15}$*d.*

8. If a yard of cloth is worth 42 shillings, what is the worth of 5 pieces, each 19 yards? *Ans.* £199 10*s.*

9. Suppose a ship to be valued at $2824 40 cents, what will ⅞ of her cost? *Ans.* $1059 15 *cts.*

10. Abraham had fine pears, 9 of which were worth 6 cents; Billy had apples, 8 of which were worth 2 cents. Required the number of apples that Billy must give Abraham for 15 of his pears? *Ans.* 40.

11. If a gentleman whose annual income is £1200, spend £21 a week: whether will he save or run in debt, and how much in a year? *Ans. save* £108.

12. Charles told Frederick, that his purse and money were worth £3 15*s.* 6½*d.* but that the money was worth 6 times as m[illegible] the purse. Pray how much was there in it?

Ans. £3 4*s.* 9*d.*

13. Two men depart from one place, the one goes north 35 miles a day, and the other south 43 miles a day, how far are they distant the 12th day after their departure?
Ans. 936 *miles.*

14. Two men depart both from the same place, and travel the same road, the one 35 miles, and the other 43 miles every day. I demand how many miles they are distant the 12th day after their departure? *Ans.* 96 *miles.*

15. Admit that a cannon may be discharged 3 times with 9 lb. of powder; how many times will 7 cwt. 3 qrs. 17 lb. discharge the same gun? *Ans.* 295 *times.*

16. How many yards of linen may be bought for £27 11*s.* whereof 7½ yards cost £1 7*s.* 2¼*d.* *Ans.* 152 *yards.*

17. If 3 paces or common steps of a certain person be equal to 2 yards; how many yards will 160 of his paces make? *Ans.* 106 *yds.* 2 *ft.*

18. To how much amounts 172 pieces of lead, each weighing 3 cwt. 2 qrs. 17½ lb. at £8 17*s.* 6*d.* per fodder of 19½ cwt? *Ans.* £286 4*s.* 4½*d.*

19. A person failing in trade, owes in all £997; at which time he has in money, goods and recoverable debts, £420 6*s.* 3¼*d.*; now supposing these things delivered to his creditors, how much will they get per pound? *Ans.* 8*s.* 7¼*d.*

20. The circumference of the earth is about 25000 miles: at what rate per hour is a person at the middle of its surface carried round, one whole rotation being made in 23 hours 56 minutes? *Ans.* 1044 $\frac{816}{1436}$ *miles.*

21. Having sold goods for £815 12*s.* how much must I remit to my employer after deducting 1½ per cent commission? *Ans.* £803 7*s.* 3$\frac{168}{200}$*d.*

22. A captain of a ship being provided with 24000 lb. of bread for 200 seamen, of which each man eats 4 lb. per week, how long will the bread last? *Ans.* 30 *weeks.*

23. Two persons A. and B. depart from Albany for Philadelphia, but A. sets off 3 days before B. and travels 30 miles a day; B. follows after him the same road and travels 50 miles a day. I demand in how many days, and after how many miles travel will B. overtake A.?
Ans. 4½ *days, and* 225 *miles.*

24. As I was beating on the forest grounds,
Up starts a hare before my two grey-hounds,;
The dogs, being light of foot, did fairly run,
Unto her fifteen rods, just twenty-one.
The distance that she started up before
Was fourscore, sixteen rods just, and no more;
Now this I'd have you unto me declare,
How far they run before they caught the hare?
Ans. 33

25. A merchant at New-York imports from Constantinople, goods which cost $4600, the freight from thence to New-York, $225, porterage $17 35 cents, duties and fees $234 75 cents, storage $23 12½ cents, and he would gain $2125 by the bargain. I demand how much $\frac{24}{64}$ of the said goods will amount to? *Ans.* $2709 45 *c.* 9$\frac{24}{64}$ *m.*

26. A gentleman has £510 8*s.* 4*d.* per annum. I demand how much he may spend per day, so as to be able to lay up £115 yearly? *Ans.* £1 1*s.* 8*d.*

27. Bought 30 hogs for £70, and sold them for £80, now if they had cost £80, how should they have been sold to have gained after the same rate? *Ans.* £91 8*s.* 6$\frac{60}{70}$*d.*

28. If 60 gallons of water, in 1 hour's time, fall into a cistern containing 200 gallons, and by a pipe in the same cistern there runs out 45 gallons in an hour, in what time will it be filled? *Ans.* 13 *ho.* 20 *min.*

29. A merchant failing in trade, paid 49 cents in the dollar, to his creditors, to whom he was indebted $11573. Pray what sum did he pay them? *Ans.* $5670 77 *cts.*

30. In £460 how many shillings, six-pences, four-pences, two-pences and pence, and of each an equal number? *Ans.* 4416.

31. A drover having bought 64 fat oxen at $50 a head, the expence of driving to market is $20, for butchering $33⅓, of salt $26⅔, of barrels and storage $50, and he would gain $654 on the whole, what will be the price of 27 of said oxen, in barrels? *Ans.* $1687 50 *cts.*

32. If from a rod of 6 feet long, the shadow 10 is made, I ask the steeple's height in yards, that's 90 feet in shade? *Ans.* 18.

33. An oilman bought 3 tuns of oil at £50 11*s.* 4*d.* per tun; by some accident it leaked out 85 gallons; but he is minded to sell it again so as to be free from loss. How must he sell it per gallon? *Ans.* 4*s.* 6$\frac{174}{671}$*d.*

34. If £100 gain £7 interest in 12 months; what will £63 gain in the same time? *Ans.* £4 8*s.* 2*d.* 3$\frac{52}{105}$ *qrs.*

35. If 8 lb. of pepper cost 14*s.* what will 7 cwt. 3 qrs. 14 lb. cost? *Ans.* £77 3*s.* 6*d.*

36. A certain usurer put out $75 for 12 months, and received for principal and interest, $81. Required the rate of interest? *Ans.* 8 *per cent.*

37. A bankrupt's effects amount to 11*s.* 7½*d.* per pound, what will B. get, to whom he is owing £300? *Ans.* £174 7*s.* 6*d.*

38. If a merchant in selling tea at 8*s.* per lb. gain 12 per cent. will he gain per cent. in selling the same tea at [illegible] *Ans.* 25 per cent.

39. If a draper sell coarse cloth at 11*s.* 6*d.* per yard, and thereby gain 15 per cent. what would he gain per cent. by selling the same cloth at 12*s.* per yard? *Ans.* 20 *per cent.*

40. If by selling corn at 8*s.* per bushel, the merchant gains 10 per cent; but the market falling, he was obliged to sell the rest at 7*s.* per bushel; what did he gain or lose on this last sale? *Ans.* *he lost* $3\frac{3}{4}$ *per cent.*

41. The rents of a parish amount to £3500, and a rate is granted of £131 5*s.* What is that per pound? *Ans.* 9*d.*

42. How much must be paid for the carriage of 10 cwt. 2 qrs. at the rate of $2\frac{1}{4}$*d.* per lb? *Ans.* £11 0*s.* 6*d.*

43. If a family of 7 persons consume 3 bushels of meal in a month, how many bushels will serve them when they are 21 in family? *Ans.* 9 *bushels.*

44. Some sportmen having placed a fox 100 yards distant from two hounds, and starting both together, the hounds ran $2\frac{1}{2}$ times faster than the fox. I demand how far the fox will have run before the hounds overtakes her? *Ans.* $66\frac{2}{3}$ *yds.*

45. A person being asked what hour of the afternoon it was, answered, it is between 5 and 6, and the minute hands and hour hands are together. Required the exact time? *Ans.* $27\frac{3}{11}$ *m. past 5.*

46. A dealer bought 14 pipes of wine, and is allowed 6 months credit, but for ready money gets it 6*d.* in a gallon cheaper. How much did he save by paying ready money? *Ans.* £44 2*s.*

47. The earth revolves round the sun in 365 days, 6 hours, 9 minutes, describing according to Dr. Stewart's theory, an orbit of 744457824 miles. How many miles does it move in a minute? *Ans.* $1415\frac{211699}{525969}$ *miles.*

48. If 12 pears are worth 21 apples, and 3 apples cost a cent, what will be the price of fourscore and four pears? *Ans.* 49 *cents.*

49. If a lever be 100 inches long, what weight lying $7\frac{1}{2}$ inches from the end, resting on a pavement, may be moved with the force of 168lb. lifting at the other end of the lever? *Ans.* 2072 *lbs.*

50. Bought threescore barrels of provisions, for 3 times as many pounds, and sold them again for 4 times as much; but if they had cost me as much as I sold them for, what should I have sold them for, to gain after the same rate? *Ans.* £320.

51. If the distance between two places be 197 miles; how many times will a wheel of $14\frac{1}{4}$ feet circumference turn round in performing the journey? *Ans.* 7299 $\frac{3}{19}$ times.

52. If during ebb tide, a wherry should set out from Albany to go down the river, and at the same time another

should set out from Hudson, to come up the river, allowing the distance to be 30 miles: Suppose the current forwards one and retards the other 2½ miles an hour; the boats are equally laden, the rowers equally good, and in the ordinary way of working in still water, would proceed at the rate of 5 miles an hour. The question is where in the river will the two boats meet? *Ans.* { 22½ *m. from Albany.* 7½ *m. from Hudson.*

53. The swiftest velocity of a cannon ball is about 2000 feet in a second of time; then in what time, at that rate, would such a ball be in moving from the earth to the sun; admitting the distance to be 100 million of miles, and the year to contain 365 days, 6 hours?

Ans. 501 *yrs.* 49 *w.* 2 *ho.*

54. The slow or parade step being 70 paces per minute, at 28 inches per pace, it is required to determine at what rate per hour that movement is?

Ans. 1 *mile,* 6 *fur.* 33 *per.* 5 *yds.* 0 *ft.* 6 *in.*

55. If in 4 months I spend as much as I gain in 3 months, how much can I lay up at the years end, if I gain every 6 months £150? *Ans.* £75.

56. If a piece of velvet 30 yards long, cost £15, how much will a Dutch ell come to if 3 yards are equal to 4 ells?

Ans. 7*s.* 6*d.*

57. If 2 lb. of pepper cost half a dollar, what will 60 lb. of cloves come to, if 3 lb. of cloves are worth 16 lb. of pepper? *Ans.* $80.

58. A. travels 12 miles a day, and when he has been gone 15 days, B. sets out after him. I demand how many miles in a day B. must go to overtake A. in 60 days?

Ans. 15 *miles.*

59. If by selling tea at 13*s.* 6*d.* a lb. I gain 35 per cent. Pray what was it bought for? *Ans.* 10*s.*

60. If 10 and 6 make 20, how much makes 6 and 8?

Ans. 17½

61. Suppose a grey-hound makes 27 springs whilst a hare makes 25, and the springs are alike: now if the hare is 50 springs before the hound, how many springs will the hound make in overtaking the hare? *Ans.* 675

62. When I sell a yard of Oznaburgh at 15*d.* I gain 30*s.* by the piece, and when I sell the yard at 14*d.* I gain 20*s.* by the same piece. I demand how many yards the piece contained? *Ans.* 120.

63. There is a certain cylindrical rod 36 inches long, at the extremities of which are suspended two weights, the one 5 pounds and the other 7. I demand the point of the rod where two weights will be in equilibro? *Ans.* 15 in. from 7 lb.

64. Sold a quantity of muslin for $588, and by so doing lost 16 per cent. whereas in dealing I ought to have cleared 25 per cent. How much then was it sold under the just value? *Ans.* $287.

THE RULE OF THREE INVERSE.

Whereas in the Rule of Three Direct, more required more, or less required less, so here the contrary takes place, more requires less, and less requires more.

RULE.—As in the Rule of Three Direct, state and prepare the question; then multiply the first and second terms together, and divide the product by the third. The quotient will be the answer in the name, or denomination of the second.

EXAMPLES.

1. A captain of a ship, being provided with provisions for 40 men, 10 months. How long would those provisions serve 32 men? *Ans.* 12½ *months.*

2. A merchant has agreed with a carrier to transport 12 cwt. of goods 70 miles, for 13 French crowns, but the waggons being laden, the carrier is obliged to leave 2 cwt. however, the merchant will still give the 13 crowns, on condition of carrying the goods proportionably further. Required the number of miles they must be carried? *Ans.* 84 *miles.*

3. If 40 poles in length and 4 in breadth, make an acre, what must be the length to make an acre when the breadth is 15 poles? *Ans.* 10 *poles,* 3 *yds.* 2 *ft.*

4. How many yards of paper that is 3 quarters wide will be sufficient to line a room that is 24 yards round and 4 yards high? *Ans.* 128 *yards.*

5. If 50 horses are maintained a year in grain for a certain sum, when oats are sold at 2*s.* 3*d.* per bushel, how many horses may be maintained a year in grain for the same sum, when oats are at 2*s.* 6*d.* per bushel? *Ans.* 45 *horses.*

6. If 136 masons are able to build a fort in 28 days, but that it was required to have it finished in 8 days; what number of masons must be employed so as to complete it in that time? *Ans.* 476 *masons.*

7. The governor of a besieged place having provisions for 54 days, at the rate of 1½ lb. of bread, but being desirous to prolong the siege to 80 days, in expectation of succour, in that case what must the ration of bread be? *Ans.* $1\frac{1}{80}$ *lb.*

8. Suppose 4000 soldiers in a town, were provided with provisions for 3 months, how many men must the commanding officer dismiss that the provisions may last 8 months? *Ans.* 2500

9. How much in length, that is 4 inches broad, will make a square foot? *Ans.* 36 *inches.*

10. A board is 48 inches long, how much in breadth must there be to make $1\frac{1}{4}$ square foot? *Ans.* $5\frac{1}{4}$ *inches.*

11. A. borrowed of B. $400 for 3 years; how long ought A. to lend B. $748, to requite his kindness.
Ans. 1 *yr.* 7 *mo.* $7\frac{404}{748}$ *days.*

12. There is a cistern having a pipe, which will empty it in 15 hours; how many pipes of the same capacity will empty it in 3 quarters of an hour? *Ans.* 20 *pipes.*

13. If when wheat is 13*s.* 6*d.* per bushel, the shilling loaf weigh 2 *lb.* 12 *oz.* what must it weigh when wheat is 10*s.* per bushel? *Ans.* 3 *lb.* $11\frac{4}{15}$ *oz.*

14. If 6 men in 24 days mow 72 acres, in how many days will 8 men mow the same? *Ans.* 18 *days.*

15. If a field will feed 6 cows 90 days, how long will it feed 20 cows? *Ans.* 27 *days.*

16. A wall that is to be built to the height of 27 feet, was raised 9 feet high by 12 men in 6 days; then how many men must be employed to finish the wall in 4 days, at the same rate of working? *Ans.* 36 *men.*

17. Wanting just an acre of land cut off from a piece which is $13\frac{1}{2}$ poles in breadth, what length must the piece be?
Ans. 11 *poles,* 4 *yards,* 2 *feet,* $0\frac{18}{27}$ *in.*

18. If a horseman rides 100 miles in 33 hours 20 minutes, in what time would he ride the same distance, if he went at the rate of $5\frac{1}{4}$ miles an hour? *Ans.* 19 *ho.* $2\frac{18}{21}$ *mi.*

19. If 20 men can perform a piece of work in 12 days, how many men will accomplish another piece thrice as large in one-fifth of the time? *Ans.* 300 *men.*

20. The battering ram of Vespasian weighed, suppose 100000 lbs. and was moved, let us admit, with such a velocity by strength of hands, as to pass through 20 feet in one second of time, and this was found sufficient to demolish the walls of Jerusalem; with what velocity must a bullet that weighs but 30 lbs. be moved, in order to do the same execution? *Ans.* $666667\frac{2}{3}$ *feet per second.*

21. If 3 men or 4 women, will do a piece of work in 56 days, how long will one man and one woman be in doing the same? *Ans.* 96 *days.*

22. What weight will a person be able to keep in equilibro who presses with a force of 120 lbs. on the end of an equipoised leaver 60 inches long, which is to meet with a convenn or prop on which it is moveable, exactly 12 in: other end of the machine? *Ans.* 480 *lbs.*

The American Tutor's Guide, &c.

PART II.

VULGAR FRACTIONS.

A FRACTION is a part of something considered as an unit, and consists in two numbers, one wrote over the other with a line between them, as $\frac{1}{2}$, $\frac{2}{5}$, $\frac{15}{28}$, &c.

The number below the line is called the denominator of the fraction, because it denominates how many parts the unit is divided into, and the number above the line is called the numerator, because it numerates how many of those parts are contained in the fraction.

A vulgar fraction is either proper, improper, compound, or mixed.

A proper fraction is when the numerator is less than the denominator, as $\frac{1}{3}$, $\frac{7}{8}$, $\frac{231}{372}$, &c.

An improper fraction is such whose numerator is equal to or greater than its denominator, as $\frac{3}{3}$, $\frac{131}{45}$, &c.

A compound fraction is the fraction of a fraction, and is known by the preposition *of*, between them, as, $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{2}{5}$, &c.

A mixed number is composed of a whole number and fraction, as $4\frac{1}{4}$, $12\frac{7}{8}$, $145\frac{14}{19}$, &c.

I. *To reduce or abbreviate Fractions to their lowest terms.*

RULE.—Divide the greater term by the lesser, and that divisor by the remainder following, and so on till nothing remains; then by the last divisor divide both parts of the fraction, and the quotients will give the fraction required.

EXAMPLES.

1. Reduce $\frac{987}{3969}$ to its lowest terms?	*Ans.*	$\frac{47}{189}$.
2. Reduce $\frac{252}{364}$ to its lowest terms?	—	$\frac{9}{13}$.
3. Reduce $\frac{1344}{1536}$ to its lowest terms?	—	$\frac{7}{8}$.
4. Reduce $\frac{42000}{54000}$ to its lowest terms?	—	$\frac{7}{9}$.

II. *To reduce a mixed number to an improper Fraction.*

RULE.—Multiply the whole number by the denominator of the fraction, and to the product add the numerator; under which set the denominator.

A *whole number* may be expressed like a fraction by *putting 1 for its denominator*; thus, 5 is $\frac{5}{1}$.

EXAMPLES.

5. Reduce $23\frac{2}{5}$ to an improper fraction. *Ans.* $\frac{117}{5}$.
6. Reduce $12\frac{7}{9}$ to an improper fraction. — $\frac{115}{9}$.
7. Reduce $79\frac{12}{19}$ to an improper fraction. — $\frac{1513}{19}$.
8. Reduce $100\frac{19}{59}$ to an improper fraction. — $\frac{5919}{59}$.

III. *To reduce an improper Fraction to a whole or mixed number.*

RULE.—Divide the numerator by the denominator, and the quotient will be the whole or mixed number.

EXAMPLES.

9. Reduce $\frac{15}{7}$ to its equivalent or proper number. *Ans.* $2\frac{1}{7}$.
10. Reduce $\frac{12}{3}$ to its proper number. *Ans.* 4.
11. Reduce $\frac{3625}{65}$ to its equivalent number. — $54\frac{12}{25}$.
12. Reduce $\frac{2918}{17}$ to its equivalent number. — $171\frac{11}{17}$.

IV. *To reduce a compound Fraction to a single one.*

RULE.—Multiply all the numerators together for a new numerator, and all the denominators for a new denominator.

EXAMPLES.

13. Reduce $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{3}{4}$ to a single fraction.

$$\tfrac{1}{2} \text{ of } \tfrac{2}{3} \text{ of } \tfrac{3}{4} = \frac{1\times2\times3}{2\times3\times4} = \tfrac{1}{4} \quad \textit{Ans.}$$

14. Reduce $\frac{2}{3}$ of $\frac{3}{5}$ of $\frac{10}{11}$ to a simple fraction. *Ans.* $\frac{6}{11}$.
15. Reduce $\frac{2}{5}$ of $\frac{5}{8}$ of $3\frac{1}{2}$, to a single fraction. — $\frac{7}{8}$.
16. Reduce $\frac{2}{7}$ of $\frac{5}{8}$ of $\frac{7}{2}$ of 4, to a single fraction. — $\frac{5}{2}$.

V. *To reduce given fractions to others of a common denominator.*

RULE.—Multiply each numerator into all the denominators except its own, for a new numerator, and all the denominators together for a common denominator.

EXAMPLES.

17. Reduce $\frac{3}{4}$, $\frac{4}{5}$ and $\frac{6}{7}$ to a common denominator.

$$\tfrac{3}{4} = \frac{3\times5\times7}{4\times5\times7} = \tfrac{105}{140}, \tfrac{4}{5} = \frac{4\times4\times7}{5\times4\times7} = \tfrac{112}{140}, \text{ \& } \tfrac{6}{7} = \frac{6\times4\times5}{7\times4\times5} = \tfrac{120}{140}$$

18. Reduce $\frac{2}{7}$ and $\frac{5}{9}$ to fractions of a common demominator. *Ans.* $\frac{18}{63}$, $\frac{35}{63}$.
19. Reduce $\frac{1}{6}$, $\frac{5}{7}$, $\frac{9}{10}$ and $\frac{1}{2}$ to a common denominator. *Ans.* $\frac{35}{140}$, $\frac{100}{140}$, $\frac{126}{140}$, $\frac{70}{140}$.

2 3 and 4 to fractions of a common denom- *Ans.* $\frac{25}{30}$, $\frac{75}{30}$, $\frac{120}{30}$.

VI. *To reduce a fraction of one denomination to the fraction of another, but greater, retaining the same value.*

RULE—Reduce the given fraction to a compound one, by comparing it with all the denominations between it and that denomination you would reduce it to; lastly reduce this compound fraction to a single one.

EXAMPLES.

21. Reduce $\frac{5}{6}$ of a penny to the fraction of a pound. *Ans.* $\frac{1}{288}$
22. Reduce $\frac{4}{5}$ *dwt.* to the fraction of a *lb.* troy. *Ans.* $\frac{1}{360}$
23. Reduce $\frac{7}{8}$ of a *lb.* avoirdupois to the fraction of a *cwt.* *Ans.* $\frac{3}{392}$.
24. Reduce $\frac{5}{8}$ of *5s.* to the fraction of 21 shillings. *Ans.* $\frac{25}{168}$

VII. *To reduce a fraction of one denomination to the fraction of another, but less, retaining the same value.*

RULE—Multiply the given numerator by the parts of the denominations between it and that denomination you would reduce it to, for a new numerator, which place over the given denominator.

EXAMPLES.

25. Reduce $\frac{1}{288}$ of a pound to the fraction of a penny. *Ans.* $\frac{5}{6}$
26. Reduce $\frac{1}{360}$ of a lb. troy to the fraction of a pennyweight. *Ans.* $\frac{4}{5}$.
27. Reduce $\frac{3}{392}$ of a cwt. to the fraction of a lb. *Ans.* $\frac{7}{8}$.
28. Reduce $\frac{25}{168}$ of 21*s.* to the fraction of 5 shillings. *Ans.* $\frac{5}{8}$.

VIII. *To find the value of a fraction, in the known parts of coin, weight, measure, &c.*

RULE—Multiply the numerator by the integer, and divide by the denominator: if any thing remain, multiply it by the next inferior denomination, and divide as before.

EXAMPLES.

29. Required the value of $\frac{3}{8}$ of a pound? *Ans.* 12*s.*
30. What is the value of $\frac{6}{7}$ of £5 9*s.*? — £4 13*s.* $5\frac{1}{7}$*d.*
31. What is the value of $\frac{6}{39}$ of a ton? *Ans.* 3 *cwt.* 0 *qrs.* 8*lb.* 9*oz.* $13\frac{7}{13}$*dr.*
32. Required the value of $\frac{3}{14}$ of a mile? *Ans.* 1*fur.* 28*po.* $3\frac{1}{7}$*yds.*
33. I demand the value of $\frac{5}{8}$ of an acre? *Ans.* 2 *ro.* 20 *po.*
34. What is the value of $\frac{3}{10}$ of a day? — 7*ho.* 12*min.*

IX. *To reduce any given quantity to the fraction of any greater denomination of the same kind.*

RULE—Reduce the given quantity to the lowest term mentioned, for a numerator; then reduce the integral part to the same term, for a denominator, which will be the fraction required.

EXAMPLES.

35. Reduce 12*s.* to the fraction of a pound. *Ans.* $\frac{3}{5}$
36. Reduce £4 13*s.* $5\frac{1}{7}$*d.* to parts of £5 9*s.* — $\frac{6}{7}$
37. Reduce 3 *cwt.* 0 *qrs.* 8*lb.* 9*oz.* $13\frac{7}{13}$*dr.* to the fraction of a ton. *Ans.* $\frac{6}{39}$
38. Reduce 1 *fur.* 28 *po.* $3\frac{1}{7}$ *yds.* to the fraction of a mile. *Ans.* $\frac{3}{14}$
39. Reduce 2*ro.* 20*po.* to the fraction of an acre. — $\frac{5}{16}$
40. Reduce 7*ho.* 12*min.* to the fraction of a day. — $\frac{3}{16}$

ADDITION OF VULGAR FRACTIONS.

RULE.—Reduce the given fractions to a common denominator, then add all the numerators together, under which place the common denominator.

EXAMPLES.

1. Add $\frac{1}{2}$ and $\frac{7}{8}$ together. *Ans.* $1\frac{3}{8}$
2. Add $\frac{2}{3}$ and $\frac{3}{5}$ and $\frac{5}{7}$ into one sum. — $1\frac{103}{105}$.
3. Add $\frac{5}{9}$ and $\frac{3}{5}$ and $2\frac{1}{6}$ into one sum. — $3\frac{29}{90}$.
4. Add $\frac{3}{5}$ and $\frac{4}{5}$ of $\frac{1}{3}$, and $9\frac{3}{20}$ together. — $10\frac{1}{60}$.

When fractions are of several denominations.

RULE.—Reduce them to their proper values, and add as before.

5. Add $\frac{3}{4}$ of a pound to $\frac{5}{6}$ of a shilling. *Ans.* 15*s.* 10*d.*
6. What is the sum of £$\frac{3}{4}$ + $\frac{3}{4}$*s.* + $\frac{3}{4}$*d.* — 15*s.* $9\frac{3}{4}$*d.*
7. What is the sum of £$\frac{1}{7}$ + $\frac{2}{9}$*s.* + $\frac{5}{12}$*d.* — 3*s.* 1*d.* $1\frac{10}{21}$ *qrs.*
8. Add $\frac{3}{4}$ of a pound Troy to $\frac{1}{6}$ of an ounce. *Ans.* 9 *oz.* 3 *dwt.* 8 *grs.*
9. Add $\frac{4}{5}$ of a ton to $\frac{5}{6}$ of a lb. — 16 *cwt.* 13 *oz.* $5\frac{1}{3}$ *dr.*
10. Add $\frac{3}{4}$ of a mile to $\frac{7}{10}$ of a furlong. *Ans.* 6 *fur.* 28 *po.*
11. Add $\frac{1}{3}$ of a week, $\frac{1}{4}$ of a day, and $\frac{1}{2}$ of an hour together. *Ans.* 2 *days*, $14\frac{1}{2}$ *hours.*

[illegible] the following parcels of sugar, viz: $16\frac{1}{2}$ lb. [illegible] lb. $251\frac{1}{16}$ lb. $30\frac{5}{6}$ lb. and $11\frac{1}{4}$ lb. I de[illegible] he sold in all? *Ans.* $362\frac{37}{48}$ *lb.*

SUBTRACTION OF VULGAR FRACTIONS.

RULE 1.—Reduce the given fractions to a common denominator, then subtract the less numerator from the greater and place the remainder over the common denominator.

2. In mixed numbers when the lower fraction is greater than the upper, subtract the numerator of the lower from the denominator, and to that difference add the upper numerator, carrying one to the units place of the lower whole number.

EXAMPLES.

1. Subtract $\frac{3}{4}$ from $\frac{111}{112}$.	*Ans.*	$\frac{27}{112}$.
2. Subtract $\frac{3}{7}$ from $\frac{97}{100}$.	—	$\frac{379}{700}$.
3. Subtract $14\frac{3}{7}$ from $96\frac{1}{2}$.	—	$81\frac{19}{21}$.
4. From $\frac{12}{36}$ take $\frac{1}{7}$ of $\frac{2}{3}$.	—	$\frac{359}{378}$.
5. From $64\frac{1}{4}$ take $\frac{2}{3}$ of $\frac{3}{4}$.	—	$63\frac{3}{4}$.

When fractions are of several denominations.

RULE.—Reduce them to their proper values and subtract as before.

6. From $\frac{3}{4}$ of a pound take $\frac{3}{5}$ of a shilling. *Ans.* 14*s.* 3*d.*
7. From $\frac{3}{4}$ of a lb. Troy, take $\frac{1}{6}$ of an ounce. — 8*oz.* $16\frac{2}{3}$ *dwt.*
8. From $\frac{4}{5}$ of a ton, take $\frac{5}{6}$ of a lb.
Ans. 15 *cwt.* 3 *qrs.* 27 *lb.* 2 *oz.* $10\frac{2}{3}$ *dr.*
9. From $\frac{2}{3}$ of a league take $\frac{7}{10}$ of a mile.
Ans. 1 *m.* 2 *fur.* 16 *po.*
10. From $\frac{4}{5}$ of a chaldron take $\frac{2}{3}$ of a bushel.
Ans. 17 *bus.* $1\frac{1}{3}$ *pec.*

MULTIPLICATION OF VULGAR FRACTIONS.

RULE.—Reduce compound fractions to single ones, and mixed numbers to improper fractions; then multiply the numerators together for a new numerator, and the denominators for a new denominator.

EXAMPLES.

1. Multiply $\frac{4}{5}$ by $\frac{15}{16}$.	*Ans.*	$\frac{3}{4}$.
2. Multiply $\frac{5}{7}$ by $\frac{9}{11}$	—	$\frac{45}{77}$.
3. Multiply $8\frac{2}{3}$ by $9\frac{3}{4}$.	—	$84\frac{1}{2}$.
4. Multiply $6\frac{4}{5}$ by 8.	—	$54\frac{2}{5}$.
5. Multiply $9\frac{1}{2}$ by $\frac{1}{2}$ of $\frac{3}{4}$.	—	$3\frac{9}{16}$.
6. Multiply $\frac{1}{2}$ of $\frac{3}{5}$ by $\frac{5}{4}$ of $\frac{4}{5}$ of $\frac{5}{6}$.	—	$\frac{1}{6}$.
7. Multiply $\frac{3}{8}$ of 8 by $\frac{7}{8}$ of 5.	—	21.
8. Multiply $\frac{7}{8}$ of $7\frac{1}{3}$ by $\frac{1}{2}$ of $3\frac{2}{3}$.	—	[illegible]

DIVISION OF VULGAR FRACTIONS.

RULE.—Prepare the numbers if necessary by the rules of reduction; and divide the numerator by the numerator, and the denominator by the denominator, if they will exactly divide; but if not, then invert the terms of the divisor, and proceed as in multiplication.

EXAMPLES.

1. Divide $\frac{25}{9}$ by $\frac{5}{3}$.

$\frac{25}{9} \div \frac{5}{3} = \frac{5}{3} = 1\frac{2}{3}$ *Ans.* Or thus, $\frac{25}{9} \div \frac{5}{3} = \frac{25 \times 3}{9 \times 5} = \frac{75}{45} = 1\frac{2}{3}$ *Ans.*

2. Divide $\frac{9}{14}$ by $\frac{6}{7}$. *Ans.* $\frac{3}{4}$.
3. Divide $1\frac{1}{3}$ by $\frac{6}{5}$. — $1\frac{1}{9}$.
4. Divide $588\frac{7}{8}$ by $84\frac{1}{8}$. — 7.
5. Divide $\frac{2}{3}$ of $\frac{3}{7}$ by $\frac{2}{7}$ of $\frac{1}{9}$. — 9.
6. Divide $7\frac{7}{16}$ by $\frac{7}{8}$ of $7\frac{1}{2}$. — $1\frac{2}{15}$.
7. Divide $\frac{2}{3}$ of $\frac{1}{3}$ by $\frac{5}{7}$ of $7\frac{3}{5}$. — $\frac{7}{171}$.
8. Divide $\frac{5}{9}$ of 4 by $4\frac{5}{9}$. — $\frac{20}{41}$.

RULE OF THREE DIRECT IN VULGAR FRACTIONS.

RULE—Make the necessary preparations as before directed; then multiply continually together, the second and third terms, and the first with its parts inverted as in division, for the answer.

EXAMPLES.

1. If $\frac{5}{8}$ of a gallon cost £$\frac{5}{8}$ what will $\frac{5}{9}$ of a tun cost?

gal. £. *tun.*

If $\frac{5}{8} : \frac{5}{8} :: \frac{5}{9}$ $\quad \frac{8 \times 5 \times 5 \times 4 \times 63}{5 \times 8 \times 9 \times 1 \times 1} =$ £140 *Ans.*

2. What is the purchase of £1230 bank stock, at $108\frac{5}{8}$ per cent? *Ans.* £1336 $8\frac{1}{4}$ *cts.*
3. If 3 yards cost £$2\frac{4}{5}$ what will $14\frac{1}{4}$ yards cost? *Ans.* £13 15*s.* 4*d.*
4. If $\frac{3}{4}$ of $\frac{7}{8}$ cwt. sugar cost £$\frac{9}{10}$ what will 82 cwt. cost? *Ans.* £262 10*s.*
5. If $\frac{3}{4}$ yards of silk cost $\frac{3}{4}$ of £$\frac{5}{6}$ what is the price of $15\frac{3}{8}$ ells Flemish? *Ans.* £9 15*s.* 10*d.*
6. What part of 6d. is $\frac{2}{3}$ of 2d. *Ans.* $\frac{2}{9}$.

RULE OF THREE INVERSE IN VULGAR FRACTIONS.

RULE—State and prepare as in the rule of three direct, invert the third term in place of the first, and proceed as in division.

EXAMPLES.

1. If $\frac{3}{4}$ yard of cloth that is 2 yards wide, will make a garment, how much of any other cloth that is $\frac{3}{5}$ yard wide will make the same garment?

bread. len. bread. $\frac{2\times3\times5}{1\times4\times3}=2\frac{1}{2}$*yds. Ans.*

If $\frac{2}{1}$: $\frac{3}{4}$: : $\frac{3}{5}$

2. If I lend my friend $480 for $\frac{3}{4}$ of a year, how much ought he to lend me for $\frac{5}{12}$ of a year? *Ans.* $864.

3. If $\frac{3}{4}$ yard of cloth that is $2\frac{1}{2}$ yards wide will make a coat, what is the breadth of the cloth whereof it will take $1\frac{3}{4}$ yards to make the same coat? *Ans.* $\frac{56}{63}$*yd.*=3*qrs.* $2\frac{2}{9}$*nails.*

4. If 12 men do a piece of work in $10\frac{3}{4}$ days, in how many days will 6 men do the same? *Ans.* $21\frac{1}{2}$*days.*

5. What length must be cut off a board, that is $7\frac{3}{4}$ inches broad, to contain a square foot? *Ans.* $18\frac{18}{31}$*inches.*

6. How much in length, of a piece of land that is $11\frac{11}{12}$ poles broad, will make an acre? *Ans.* $13\frac{61}{143}$*poles.*

DECIMAL FRACTIONS.

A Decimal Fraction is such, whose denominator is not expressed, but understood; to be a unit with as many ciphers annexed as there are places in the numerator: hence $\frac{5}{10}$ will be expressed .5, $\frac{25}{100}$ expressed .25, and $\frac{125}{1000}$ expressed .125, &c. They have a point or comma prefixed, to distinguish them from integers.

A cipher placed to the left hand of an integer, or to the right of a decimal, neither increaseth nor decreaseth the value; but placed to the right hand of an integer, increaseth the value ten fold; and to the left hand of a decimal, decreaseth the value ten fold:—Two ciphers placed to the right hand of an integer, increaseth the value one hundred fold; and to the left hand of a decimal, decreaseth the value one hundred fold, &c. as in the following table of numeration.

Hundreds of Millions.	Tens of Millions.	Millions.	Hundreds of Thousands.	Tens of Thousands.	Thousands.	Hundreds.	Tens.	Units.	Parts of Ten.	Parts of One Hundred.	Parts of One Thousand.	Parts of Ten Thousand.	Parts of One Hund. Thou.	Parts of a Million.	Parts of Ten Million.	Parts of One Hund. Mill.
9	8	7	6	5	4	3	2	1	.2	3	4	5	6	7	8	9
Integers, or Whole Numbers.									Decimal Parts or Fractions.							

In the preceding table it also plainly appears, that as integers or whole numbers increase by a ten fold proportion towards the left hand, so decimal parts decrease towards the right hand by the same proportion.

So, 5, 50, 500, 5000 is Five, Fifty, Five Hund., Five Thous.

And, .5, .05, .005, .0005 is Five Parts of Ten, One Hundred, One Thousand, Ten Thousand.

A finite decimal is that which ends at a certain number of places; but an infinite, is that which no where ends.

A repeating or circulating decimal, is that wherein one or more figures are continually repeated.

Thus, .3333, &c. or $.\dot{3}$, is called a pure repeater. Also, .2666, &c. or $.2\dot{6}$, is called a mixed repeater.

And .090909, &c. or .181818, &c. are called pure circulates, and consists of the figures of the circle only; .04545, &c. or .32142857142857, &c. are called mixed circulates.

Repeating and circulating numbers are marked by a point over the repeating figures, as in $.\dot{4}\dot{5}$ or $.\dot{2}$.

Note.—In all operations, if the result consists of several nines, reject them, and make the next superior place one more. Thus for 17.1999 write 17.2; and for 13.999 write 14, &c.

REDUCTION OF DICIMALS.

I. *To reduce a vulgar fraction to its equivalent decimal fraction.*

RULE—To the numerator of the vulgar fraction affix a point. then annex a competent number of ciphers, and divide by the denominator: the quotient is the numerator of the dicimal, d ixed show the number of decimal places.

EXAMPLES.

1. Reduce $\frac{1}{4}$, $\frac{1}{2}$, and $\frac{3}{4}$ of a dollar to equivalent decimal fractions, or to cents. *Ans.* $\$\frac{1}{4}$=.25c. $\$\frac{1}{2}$=.5d. $\$\frac{3}{4}$=.75*cents*.
2. Reduce $\$\frac{3}{8}$ to a dicimal fraction. *Ans.* .375.
3. Reduce $\frac{1}{25}$ to a decimal. — .04.
4. Reduce $\frac{3}{192}$ to a decimal. — .015625.
5. Reduce $\frac{7}{24}$ to a decimal. — .2916666.
6. Reduce $\frac{275}{3842}$ to a decimal. — .0715773.
7. Reduce $\frac{11}{14}$ of $\frac{10}{13}$ to a decimal. — ·6043956.
8. Reduce $\frac{3}{4}$ of $\frac{1}{2}$ of $\frac{7}{8}$ to a decimal. — .328125.

II. *To reduce the known parts of money, weight, measure, &c. into decimals.*

RULE—Annex ciphers as before, to the lowest denomination, and divide by that number which make one of the higher denomination given, the quotient will be the decimal. Otherwise bring the parts to a vulgar fraction, and then reduce it to a decimal.

EXAMPLES.

9. Reduce 1s. $2\frac{1}{4}$d. to the decimal fraction of a pound. *Ans.* £ .059375.
10. Reduce 5s. N. Y. currency to the decimal of a dollar. *Ans.* $.625.
11. Reduce 9d. to the decimal of a pound. *Ans.* £.0375
12. Reduce 8 oz. 15dwt. 18gr. to the decimal of a lb. troy. *Ans.* .7322916lb.
13. Reduce 3qrs. 19lb. 14oz. to the decimal of a cwt. *Ans.* .927455*cwt.*
14. Reduce 1.5 pint to the decimal of a gallon. *Ans.* .1875.
15. Reduce .21 pints to the decimal of a peck. —.013125
16. Reduce 24 yards to the decimal of a mile. —.013636.
17. Reduce 3 qrs. 2 nails to the decimal of a yard. — .875.
18. Reduce 4 poles to the decimal of an acre. — .025.
19. Reduce 14 minutes to the decimal of a day. —.009722*d.*
20. Reduce 52 days to the decimal of a year. —.1424657*y.*

III. *To find the value of decimals in known parts of money, weight, measure, &c.*

RULE.—Multiply the decimal by the parts in the next inferior denomination, cutting off the decimals from the product; then multiply the remainder by the next inferior denomination; thus proceeding till you have brought in the least known parts of the integer.

EXAMPLES.

21. What is the value of £ ·775? *Ans.* 15*s.* 6*d.*
22. Required the value of .625 shillings? *Ans.* 7½ *d.*
23. What is the value of £ .8635? *Ans.* 17*s.* 3.24*d.*
24. What is the value of .0125 lb. troy? — 3*dwts.*
25. What is the value of .625 cwt? — 2*qrs.* 14*lb.*
26. What is the value of .009943 miles? —17*yd.* 1*ft.* 5.98848*in.*
27. What is the value of .875 yd.? — 3*qrs.* 2*na.*
28. Quere the value of .025 acre? — 4 *poles.*
29. What is the value of 3 years? — 109*dys.* 12*ho.*
30. What is the value of .4765 days? —11*ho.* 26*m.* 9*s.* 36*th.*

ADDITION OF DECIMALS.

RULE—Place the numbers so that the decimal points may stand all exactly under each other, then add as in whole numbers; and point off as many places for decimals as there are the most in any of the given numbers.

EXAMPLES.

1. Add together 29.0146, 3146.5, 2109, .62417 and 14.16? *Ans.*
2. What is the sum of 376.25+86.125+637.4725+6.5+41.02+358.865? *Ans.*
3. Required the sum of 3.5+47.25+2.0073+927.01+1.5? *Ans.*
4. Required the sum of £. 9$\frac{369}{492}$+£. 101.65+£. 54.1375 and .625 shillings? *Ans.* £165.56875=£165. 11*s.* 4½*d.*

SUBTRACTION OF DECIMALS.

RULE—Place the numbers under each other according to the value of their places, subtract as in whole numbers, and point off the decimal places as in addition.

EXAMPLES.

1. Required the difference between 91.73 & 2.138572? *Ans.*
2. Subtract 1.9185 from 2.73. *Ans.*
3. Subtract .98765 from 1. —
4. Subtract £ .58125 from 15*s.* 3¾*d.* *Ans.* £ .184375=3*s.* 8¼*d*

MULTIPLICATION OF DECIMALS.

RULE.—Place the factors and multiply as in whole numbers, and from the product point off as many places for decimals as there are in both factors; but if there should not be so many, supply the defect by prefixing ciphers to the left hand.

EXAMPLES.

1. Multiply .2531 by 30.5		7. Multiply 27.35 by 7.70042	
2. Multiply 7.346 by .017		8. Multiply 54.32 by .0075	
3. Multiply .01538 by .173		9. Multiply .009 by .009	
4. Multiply 6421.3 by .5342		10. Multiply 500 by .0002	
5. Multiply 72347 by 23.15		11. Multiply 10 by .01	
6. Multiply 17102 by .3162		12. Multiply .1 by .1	

13. Multiply thirty-one and six tenths by twenty-five. *Ans.* 790.

14. Multiply ninety-five thousandths by six hundredths. *Ans.* .0057.

15. Multiply one thousand and eight and four tenths by fifty-five. *Ans.* 55462.

QUESTIONS FOR EXERCISE.

16. If 1 bushel of corn .75 cents, what will 64 bushels cost? *Ans.* $48.

17. If 1 day's labor be $1 12½ cents, what will 27 days amount to? *Ans.* $30 37½ *c.*

18. What will 36 lb. of flax amount to at .17 cents per lb? *Ans.* $6 12 *c.*

19. Multiply 2*s.* 6*d.* by 2*s.* 6*d.* and let 1*s.* be the integer? *Ans.* 6.25=6*s.* 3*d.*

20. Multiply 2*s.* 6*d.* by 2*s.* 6*d.* and let £1 be the integer? *Ans.* .015625=0*l.* 0*s.* 3¾*d.*

21. What will 13 cwt. 2 qrs. of iron come to at $4 56 c. per cwt. *Ans.* $61 56 *c.*

22. What will 31496 feet of boards amount to at $8 per M. feet? *Ans.* $251 96 *c.* 8 *m.*

23. If 1 yard of cloth cost 7*s.* what will 25 yards cost? *Ans.* 8*l.* 15*s.*

24. How much will 12 cwt. 3 qrs. 14 lb. of sugar come to at 4*l.* 12*s.* per cwt? *Ans.* 59*l.* 4*s.* 6*d.*

DIVISION OF DECIMALS.

RULE—Divide as in whole numbers, and from the right hand of the quotient, point off as many places for decimals as the decimal places in the dividend exceed those in the divisor.

If there should be a remainder, or more decimal places in the divisor than the dividend, ciphers may be annexed to the dividend or remainder, and the quotient extended to any degree of accuracy.

If the decimal places of the quotient be not so many as the rule require, prefix ciphers to the left hand.

EXAMPLES.

1. Divide 72117 by 225		3. Divide 71865 by 25	
2. *Divide 136 by 759*		4. Divide 87 by 2	

5. Divide	48 by	.3715	12. Divide	.594868 by	7.18
6. Divide	35.7485 by	216	13. Divide	.274869 by	.756
7. Divide	2718.5685 by	37.005	14. Divide	.81748 by	·075
8. Divide	675.008 by	.075	15. Divide	.9 by	.000125
9. Divide	.007586 by	215	16. Divide	7854 by	10
10. Divide	.41312 by	173	17. Divide	7854 by	1000
11. Divide	.087945 by	37.5			

18. Divide, seven hundred and ninety by thirty-one and six-tenths. *Ans.*

19. Divide fifty-seven ten thousandths by six hundredths. *Ans.*

20. Divide fifty-five thousand four hundred and sixty-two by one thousand and eight and four-tenths. *Ans.*

QUESTIONS FOR EXERCISE.

I. *From a given multiplier to find a divisor that gives a quotient equal to the product.*

RULE—Divide 1 with ciphers annexed by the given multiplier, and the quotient will be the divisor required.

EXAMPLES.

21. What divisor will give a quotient equal to the product of 125? *Ans.* .008

22. What divisor will give a quotient equal to the product of 625? *Ans.* .0016

23. Find a divisor that will give a quotient equal to the product of 3125? *Ans.* .00032

II. *From a given divisor to find a multiplier that gives a product equal to the quotient.*

RULE—Divide 1 with ciphers annexed by the given divisor, and the quotient will be the multiplier required.

EXAMPLES.

24. What multiplier will give a product equal to the quotient arising from the same number divided by .008? *Ans.* 125

25. What multiplier will give a product equal to the quotient arising from the same number divided by .0016? *Ans.* 625.

26. Divide 7315 by .008, or multiply by 125. Quere, the result. *Ans.* The quotient and product equal. 914375.

27. Divide 785 by .00032, or multiply by 3125. Quere the quotient and product? *Ans.* Both the same. 2453125.

28. The multiplier that will produce equal to the quotient arising from the same number divided by .00032 is required? *Ans.* 3125.

29. Divide $115 65 c. among 5 men, so that 4 men may have equal shares; and the 5th only half a share?

Ans. { $25 60 c. to 4 men each, and
$12 85 c. to the 5th.

30. Divide $226 87 c. 5 m. among 3 white men and 1 negro, so as the whites may have equal shares, and the negro only $\frac{3}{4}$ of a share ?
Ans. $60 50 *c.* to each white man and $45 37½ *c.* to the negro.

SINGLE RULE OF THREE IN DECIMALS.

RULE—Reduce the fractional parts into decimals, then state the question, and proceed according to the rules given for Direct and Inverse Proportion, or by the following general

RULE—In every question in the Rule of Three,

Three given numbers there must always be ;
Like what you seek must in the middle stand,
And that which gives it the first place demands.
What asks the question the third term must be,
The first and third in name and kind agree.
If *more* you want, the *less* divisor make,
If *less* the *greater* for divisor take.

EXAMPLES.

1. Suppose I give 12s. 6d. for 4¾ yards of linen: what will 48½ yards of the same come to at that rate.
Ans. £6.3815789=6*l.* 7*s.* 7½*d.*

2. A grocer buys 4 chests of tea, each weighing neat 2 cwt. 3qrs. 14 lb. for $906 50cts. at what rate did he give per lb.
Ans. $.7038048=70*cts.* 3.8*m.*

3. How much persian .75 yards wide, will line 25.5 yards of 5 quarters wide ? *Ans.* 42½*yds.*

4. If 1½ lb. of indigo cost $3.84, what will 24.6 lb. cost at that rate ? *Ans.* $62.976

5. A. owes B. $1851.75 but B. compounds with him for 66⅔ cents on the dollar, what must B. receive for his debt ?
Ans. $1234⅓.

6. A merchant bought 4 tuns, 201½ gallons of Corsica wine, for 240l. 16s. 6d. but by misfortune it chanced to leak out 24½ gallons, I demand to know what the remainder stands him in per gallon ? *Ans.* £.2032278=4*s.* 0*d.* 3*qrs.*

7. Goliath is said (in 1 Samuel chap. xvii. v. 4.) to have been 6 cubits and a span high ; this answers to 10 feet 4$\frac{74}{125}$ inches. Pray what was the length of the cubit in United States or British measure ? *Ans.* 1*ft.* 7.168 *in.*

8. If a board be 9 inches broad, what length will it require to measure 12 square feet ? *Ans.* 16*feet.*

9. The cubic inch of marble, is 1.5688 oz. avoirdupois ? what difference is there, in point of weight, between a figure containing a solid foot and half thereof, and another of equal dimensions in brass 4.63 oz. whereof make a cubic inch ?
Ans. 7934.6304*oz.*=4*cwt.* 1*qr.* 19*lb.* 14*oz.* 9.8

10. *If the cubic inch of olive oil be .52835 decimal pa*

an ounce avoirdupois: what quantity of oil weighing $7\frac{1}{2}$ lb. per gallon, will be contained in a cask allowed to hold $13\frac{1}{2}$ gallons of water, each 282 solid inches?

Ans. 16.555*gall.*=16*gall.* 2.22*qts.*

11. Hiero, King of Sicily, ordered his jeweller to make him a crown, containing 63 ounces of gold; the workman thought substituting part silver therein, to have a proper perquisite, which taking air, Archimedes was appointed to examine it, who on putting it into a vessel of water found it raised the fluid, or that itself contained 8.2245 cubic inches of metal, and having discovered that the cubic inch of gold more critically weighed 10.36 ounces, and that of silver but 5.85 ounces, he, by calculation, found what part of his Majesty's gold had been changed, and you are desired to repeat the process. *Ans.* 34.1964*oz.* of gold, and 28.8036*oz.* of silver.

12. Suppose A. lend to B. $1675 for 6 months, what sum must B. lend A. for $3\frac{1}{4}$ years to requite him? *Ans.* $223 $33\frac{1}{3}$c.

13. If 60 gallons of water in 1 hour and 15 minutes fall into a cistern containing 225 gallons, and by a pipe in the cistern there runs out 45 gallons in the same time, in what time will it be filled? *Ans.* $18\frac{3}{4}$ *hours.*

14. What length of a board 9 inches broad will make a square foot, or as much as 1 foot in length & 1 foot in breadth contains?

Ans. 1 *ft.* 4 *in.*

15. There is a cistern having a pipe which will empty it in 2 hours 45 minutes. How many pipes of the same capacity will empty it in 15 minutes? *Ans.* 11 *pipes.*

16. How many yards of matting that is 2 feet 6 inches broad, will cover a floor that is 27 feet long and 20 broad?

Ans. 72 *yds.*

17. A cistern having a pipe running into it which will fill it in 12 minutes; this same cistern has four emptying pipes, the first of which will empty it in 2 hours, the second will empty it in 1 hour 15 minutes; the third will empty it in 48 minutes, and the fourth will empty it in 30 minutes: required in what time the cistern will be filled if all five run together.

Ans. 2 *ho.* 13 *m.* 20 *s.*

REPEATING AND CIRCULATING DECIMALS.

As the arithmetic of infinite *Decimals* is generally considered a subject as much of curiosity as of real use, we shall at ent only give the rules by which they are reduced to vul- and by means of which any question where be wrought.

nal be a pure repeater, place the repeating nerator, and 9 for the denominator.

EXAMPLE 1.

Suppose .2222, &c. or $.\dot{2}$ to be a pure repeating decimal, what is its equivalent vulgar fraction? *Ans.* $\frac{2}{9}$

II. If the decimal be a pure circulate, place the circulating figures for the numerator, and as many 9's as there are places in the circle for the denominator.

EXAMPLE 2.

When the pure circulating decimal is .259259259, &c. or $.\dot{2}5\dot{9}$ what is its vulgar fraction? *Ans.* $\frac{259}{999}=\frac{7}{27}$

III. If there be ciphers prefixed to the repeating or circulating figures, annex a like number to the 9's in the denominator.

EXAMPLE 3.

Let .0555, &c. or $.0\dot{5}$ be the repeating, and .0148148, &c. or $.0\dot{1}4\dot{8}$ the circulating figures, required their equivalent vulgar fractions? *Ans.* $\frac{5}{90}=\frac{1}{18}$ and $\frac{148}{9990}=\frac{2}{135}$

IV. If the decimal be mixed, subtract the finite part from the whole decimal; the remainder is the numerator, and the denominator consists of as many 9's as there are places in the circle, with as many ciphers annexed as there are finite places in the decimal before the circle.

EXAMPLE 4.

What is the vulgar fraction of .58333, &c. or $.58\dot{3}$.

From the whole decimal .583
Subtract the finite part. 58

Ans. $\begin{cases}\text{numerator} & 525 \\ \text{denominator} & 900\end{cases}=\frac{7}{12}$

QUESTIONS FOR EXERCISE.

5. Reduce .1666, &c. or $.1\dot{6}$ to a vulgar fraction. *Ans.* $\frac{15}{90}=\frac{1}{6}$.

6. Reduce .08333, &c. or $.08\dot{3}$ to a vulgar fraction. *Ans.* $\frac{75}{900}=\frac{1}{12}$

7. Reduce .04545, &c. or $.04\dot{5}$ to a vulgar fraction. *Ans.* $\frac{45}{990}=\frac{1}{22}$.

8. Reduce .04166, &c. or $.041\dot{6}$ to a vulgar fraction. *Ans.* $\frac{375}{9000}=\frac{1}{24}$.

9. Reduce $.1\dot{1}5384\dot{6}$ to a vulgar fraction. *Ans.* $\frac{1153846}{9999990}=\frac{3}{26}$

10. Reduce $8.\dot{3}$ to a vulgar fraction. *Ans.* $\frac{75}{9}$.

11. Reduce $65.\dot{2}9\dot{6}$ to a vulgar fraction. *Ans.* $\frac{65231}{999}=\frac{17}{9}$.

12. Reduce $4.1\dot{6}$ to a vulgar fraction. *Ans.* $\frac{375}{90}=2\frac{5}{6}$

13. Reduce $.\dot{5}3571428$ to a vulgar fraction.

Ans. $\frac{53571375}{99999900}=\frac{17}{33}$

14. Reduce $8.3\dot{2}1428\dot{5}\dot{7}$ to vulgar fraction.

Ans. $\frac{832142025}{99999900}=2\frac{33}{28}$

COMPOUND PROPORTION.

Compound Proportion teaches how to resolve such questions as require two or more statings by Simple Proportion.

RULE—Set down in the middle place that term of supposition which is of the same kind with the answer sought.—Take one of the other terms of supposition, and one of the demanding terms of the same kind with it; then place one of them for a first term, and the other for a third, according to the directions given in the Rule of Three. Do the same with another term of supposition, and its corresponding demanding term; and so on if there be more terms of each kind, setting the numbers under each other which fall all on the left-hand side of the middle term, and the same for the others on the right-hand side. Multiply together all the terms standing under each other on the left-hand side of the middle term; and in like manner, multiply all those on the right-hand side of it. Then multiply the middle term by the latter product, and divide the result by the former product, so shall the quotient be the answer.

Note—When you find any of the proportions to be inverse, place the demanding term on the left, and its corresponding term of supposition on the right-hand side.

EXAMPLES.

1. If 40 acres of grass be cut down by 8 men in 7 days, how many acres will 24 men cut down in 28 days?

	men.		*acres.*		*men.*
If	8	:	40	: :	24
days	7				28 days.

$$\frac{24\times28\times40}{8\times7}=480 \textit{ acres Ans.}$$

2. If 14 horses eat 56 bushels of corn in 16 days, how many bushels will 20 horses eat in 24 days? *Ans.* 120 *bush.*

3. If 48 bushels of corn yield 576 in one year, how much will 240 bushels yield in 6 years at that rate? *Ans.* 17280 *b.*

[illegible] roods of ditching be done by 3 men in 6 days, how [illegible] will be done by 8 men in 4 days? *Ans.* 32 *roods.*

5. If 14 horses eat 56 bushels of corn in 16 days, in how many days will 20 horses eat 120 bushels? *Ans.* 24 *days.*

6. If 40 acres of grass be cut down by 8 men in 7 days, in how many days will 480 acres be cut down by 24 men? *Ans.* 28 *days.*

7. If 12 inches of length, 12 of breadth, and 12 of thickness, make a solid foot; what length of a plank that is 6 inches broad and 4 inches thick will make a solid foot? *Ans.* 72 *inches.*

8. If 3000 lb. of beef serve 340 men 15 days, how many lbs. will serve 120 men 25 days? *Ans.* 1764 *lb.* $11\frac{15}{17}$ *oz.*

9. If 15 men eat 13*s.* worth bread in 6 days, when wheat is sold at 12*s.* per bushel, in how many days will 30 men eat 43*s.* 4*d.* worth of bread, when wheat is at 10*s.* per bushel? *Ans.* 12 *days.*

10. If 18 men build a wall 40 feet long, 3 feet thick and 16 feet high in 12 days, how many men will build a wall 360 feet long, 8 feet thick and 10 feet high in 60 days? *Ans.* 54 *men.*

11. If 12 men cast a ditch 30 feet long, 6 deep, and 3 broad in 15 days, when the day is 12 hours long; in how many days will 60 men cast a ditch 300 feet long, 8 deep, and 6 broad, when the day is but 8 hours long? *Ans.* 120 *days.*

12. If 1 lb. of gold is about 14 times more valuable than 1 lb of silver, and the proportion of its weight to that of silver is as 19 to 10: Required the value of a bar of silver equal in bulk to one of gold worth £1000? *Ans.* 37*l.* 11*s.* $10\frac{148}{266}$*d.*

13. If 3 masters, who have each 8 apprentices, in 5 weeks, each week 6 days, earn $360; how much will 5 masters, who have each 10 apprentices, earn in 8 weeks, each week $5\frac{1}{2}$ days, their daily wages being the same? *Ans.* $1100.

14. How many pears can I have for $1 35cts. if 70 chesnuts are worth 50 almonds, and 48 almonds 1 pomegranate, and 28 lemons 18 pomegranates, and 25 pears 10 lemons, and 108 chesnuts cost $2\frac{1}{4}$ cents? *Ans.* 375 *pears.*

15. A. B. has a negotiable note for 876*l.* 14*s.* 10*d.* due in 79 days but being in want of ready money, he has agreed with C. D. to discount it at the rate of 6 per cent per annum, How much has A. B. to receive? *Ans.* 865*l.* 7*s.* $1\frac{4092}{9125}$

16. If a cistern of $17\frac{1}{2}$ feet long, $10\frac{1}{2}$ feet broad, and 13 feet deep, holds 546 barrels of water, how many barrels will a cistern hold that is 16 feet long, 7 feet broad, and 15 feet deep? *Ans.* 384 barrels.

17. If 12 shoemakers, in 2 weeks, make 36 pair of men's and 24 pair of women's shoes; how many pair of each sort, would 18 shoemakers make in 5 weeks?

Ans. 135 *pair of men's*, 90 *pair women's.*

18. If 12 oxen be maintained on 15 acres for 4 months, how many sheep will be maintained on 36 acres for 3 months, supposing 7 sheep to eat as much as 1 ox. *Ans.* $268\frac{36}{43}$ *sheep.*

19. A certain sum of money was lent at simple interest, which in 8 months amounted to $297 60 *cts.* and in 15 months to $306. I demand the principal and rate of interest!

Ans. $288 *principal*, $5 *rate per cent.*

20. If 80000 cwt. of ammunition were to be removed from a place in 9 days, and that in six day's time 4500 cwt. was carried away with 18 horses; how many horses will be wanted to carry away the remainder in 3 days?

Ans. 604 *horses.*

21. If A. raises goods worth $30 to $40 and gives 9 months credit, how high must B. raise goods worth $27 he agreeing to give 10 months credit? *Ans.* $37.

22. A meal-monger purchased 22 sacks of meal, each containing 280*lbs.* 7 sacks he bought at 50*s.* per sack, 10 at 60*s.* and the rest at 74*s.* per sack; this meal he mingles all together, and desires to know how he must sell it per stone of 14*lbs.* to gain 50 per cent by the mixtures?

Ans. 4*s.* 6*d.*

23. A wall was to be built 700 yards long in 29 days; now after 12 men had been employed on it for 11 days, it was found that they had completed only 220 yards of the wall. It is required then to determine how many men must be added to the former, that the whole number of them may just finish the wall in the time proposed?

Ans. 4 *men to be added.*

24. A ship being manned with 300 men, and provided with bread for 12 months, so that each man is allowed 30 ounces per day, but having been 6 months on their voyage, they find it will require 9 months more before they can finish it, and having lost 50 of their number by death, now tell me the daily allowance of bread for each man during the said 9 months? *Ans* 24 *ounces.*

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PART III.

PRACTICE.

PRACTICE is a compendious method of performing questions in the Rule of Three by taking aliquot, or even parts.

One number is said to be an aliquot part of another, when the former divides the latter without a remainder.

TABLES.

qr.		*s.*	*d.*		*lb.*		*cwt. qrs.*	
1 = $\frac{1}{4}$	*of 1d.*	1	0 = $\frac{1}{20}$	*Of a Pound*	7 = $\frac{1}{16}$	*Of a Hund. wt.*	1 0 = $\frac{1}{20}$	*Of a Ton.*
2 = $\frac{1}{2}$		1	8 = $\frac{1}{12}$		8 = $\frac{1}{14}$		1 1 = $\frac{1}{16}$	
d.		2	0 = $\frac{1}{10}$		14 = $\frac{1}{8}$		2 0 = $\frac{1}{10}$	
1 = $\frac{1}{12}$	*Of a Shilling.*	2	6 = $\frac{1}{8}$		16 = $\frac{1}{7}$		2 2 = $\frac{1}{8}$	
1½ = $\frac{1}{8}$		3	4 = $\frac{1}{6}$		28 = $\frac{1}{4}$		4 0 = $\frac{1}{5}$	
2 = $\frac{1}{6}$		4	0 = $\frac{1}{5}$		56 = $\frac{1}{2}$		5 0 = $\frac{1}{4}$	
3 = $\frac{1}{4}$		5	0 = $\frac{1}{4}$				10 0 = $\frac{1}{2}$	
4 = $\frac{1}{3}$		6	8 = $\frac{1}{3}$					
6 = $\frac{1}{2}$		10	0 = $\frac{1}{2}$					

I. *When the price of* 1 *lb. yard, &c. is less than a penny.*

RULE—Take such aliquot part, or parts of the given quantity, as the price is of a penny, for the answer in pence; which reduce to pounds.

Note—When the complement of the given price, in any case, is an aliquot part, deduct the said aliquot part of the given quantity therefrom, and the remainder will be the answer.

EXAMPLES.

1. 2107 at ¼*d.* *Ans.* 2*l.* 3*s.* 10¾*d*
2. 1470 at ½*d.* — 3*l.* 1*s.* 2*d.*
3. 1276 at ⅓*d.* — 3*l.* 19*s.* 9*d.*
4. 15312 at ¼*d.* *Ans.* 15*l.* 19*s.*
5. 7656 at ½*d.* — 15*l.* 19*s.*
6. 9423 at ⅓*d.* — 29*l.* 8*s.* 11¼*d*

II. *When the given price of* 1 *lb. yard, &c. is a penny or more, but less than a shilling.*

RULE—Take such part or parts of the given quantity, as the price is of a shilling, for the answer in shillings, which reduce to pounds.

EXAMPLES.

7. 1762 at 1*d.* *Ans.* 7*l.* 6*s.* 10*d*
8. 1400 at 1½*d.* — 7*l.* 5*s.* 10*d*
9. 2462 at 1½*d.* *Ans.* 15*l.*
10. 1041 at 1½*d.* — 7*l.*

11. 2490 at 2d *Ans.* 20*l.* 15*s.*
12. 2408 at 2½*d.* — 22*l.* 11*s.* 6
13. 640 at 2¾*d.* — 6*l.* 13*s.* 4
14. 1740 at 2¾*d.* — 19*l.* 18*s.* 9
15. 746 at 3*d.* — 9*l.* 6*s.*
16. 1417 at 3¼*d.* — 19*l.* 3*s.* 9½
17. 3091 at 3¾*d.* — 45*l.* 1*s.* 6½
18. 214 at 3¾*d.* — 3*l.* 6*s.* 10
19. 2000 at 4*d.* — 33*l.* 6*s.* 8
20. 569 at 4½*d.* — 10*l.* 1*s.* 6½
21. 1245 at 4½*d.* — 23*l.* 7*s.* 3
22. 1420 at 4½*d.* — 28*l.* 4*s.* 5½
23. 2740 at 5*d.* — 57*l.* 1*s.* 8
24. 2147 at 5½*d.* — 45*l.* 19*s.* 3
25. 8[illegible] at 5½*d.* — 15*l.* 8*s.* 11
26. 1785 at 5½*d.* — 41*l.* 15*s.* 7
27. 1761 at 6*d.* — 43*l.* 16*s.* 6
28. 2142 at 6½*d.* — 58*l.* 18*s.* 7
29. 1[illegible] at 6[illegible] — 28*l.* 8*s.*
30. 1[illegible] at 6[illegible] — [illegible]

31. 1000 at 7*d.* *Ans.* 29*l.* 3*s.* 4*d*
32. 1656 at 7¼*d.* — 50*l.* 0*s.* 6*d*
33. 1420 at 7½*d.* — 44*l.* 7*s.* 6*d*
34. 674 at 7¾*d.* — 21*l.* 15*s.* 3½*d*
35. 2170 at 8*d.* — 72*l.* 6*s.* 8*d*
36. 1700 at 8¼*d.* — 58*l.* 8*s.* 9*d*
37. 1765 at 8½*d.* — 62*l.* 10*s.* 2¼*d*
38. 749 at 8¾*d.* — 27*l.* 6*s.* 1½*d*
39. 1417 at 9*d.* — 53*l.* 2*s.* 9*d*
40. 2373 at 9¼*d.* — 91*l.* 9*s.* 2½*d*
41. 1476 at 9½*d.* — 58*l.* 8*s.* 6*d*
42. 1760 at 9¾*d.* — 71*l.* 10*s.*
43. 6000 at 10*d.* — 250*l.*
44. 4652 at 10¼*d.* — 198*l.* 13*s.* 7*d*
45. 2476 at 10½*d.* — 108*l.* 6*s.* 6*d*
46. 2176 at 10¾*d.* — 97*l.* 9*s.* 4*d*
47. 1276 at 11*d.* — 58*l.* 9*s.* 8*d*
48. 2142 at 11¼ — 100*l.* 8*s.* 1½*d*
49. 4[illegible] at 11½*d.* — 228*l.* 1*s.* 8*d*
50. 640 at 11¾*d.* — 31*l.* 6*s.* 8*d*

III. *When the price of 1 lb. yard, &c. is more than a shilling but less than ten.*

Rule.—Let the quantity given stand for so many shillings, to which add the amount in shillings of said quality at the overplus price, found by case 1st. or 2nd.

EXAMPLES.

51. 2140 at 1*s.* 0¾*d.*	*Ans.*	109*l.*	4*s.* 7*d.*
52. 8715 at 1*s.* 0¼*d.*	—	193*l.*	9*s.* 9½*d.*
53. 2712 at 1*s.* 0¾*d.*	—	144*l.*	1*s.* 6*d.*
54. 6[illegible] at 1*s.* 1½*d.*	—	343*l.*	2*s.* 6*d.*
55. 1210 at 1*s.* 2¼*d.*	—	74*l.*	7*s.* 3¾.
56. 1280 at 1*s.* 3*d.*	—	78*l.*	15*s.*
57. 7121 at 1*s.* 4½*d.*	—	482*l.*	3*s.* 0¼*d.*
58. 7890 at 1*s.* 6¼*d.*	—	616*l.*	8*s.* 1½*d.*
59. 7120 at 1*s.* 8¼*d.*	—	600*l.*	15*s.*
60. 1074 at 1*s.* 11¼*d.*	—	101*l.*	16*s.* 1½*l.*
61. 19998 at 1*s.* 11¼*d.*	—	1978*l.*	19*s.* 4½*l.*
62. 9999 at 1*s.* 11¼*d.*	—	989*l.*	9*s.* 8¼*d.*

IV. *When the price of 1 lb. yard, &c. is any number of shillings under 20.*

ultiply the quantity by the shillings in the price, 20; or if the price be even shillings, multiply e, and double the first figure of the product d the rest will be pounds; or, work by ali-

EXAMPLES.

63.	486 at 2*s*.	*Ans.*	48*l*. 12*s*	69.	600 at 13*s*.	*Ans.*	390*l*.
64.	121 at 3*s*.	—	18*l*. 3*s*	70.	430 at 14*s*.	—	301*l*.
65.	471 at 5*s*.	—	117*l*. 15*s*	71.	171 at 16*s*.	—	136*l*. 16*s*
66.	191 at 8*s*.	—	76*l*. 8*s*	72.	3142 at 17*s*.	—	2670*l*. 14*s*
67.	242 at 11*s*.	—	133*l*. 2*s*	73.	1621 at 18*s*.	—	1458*l*. 18*s*
68.	2101 at 12*s*.	—	1260*l*. 12*s*	74.	101 at 19*s*.	—	95*l*. 19*s*

V. *When the price of* 1 *lb. yd. &c. is shillings and pence, or shillings pence and farthings.*

RULE—Take such part or parts of the given quantity, as the price is of £1. or multiply the given quantity by the shillings and take parts for the rest, add them together and divide by 20.

EXAMPLES.

75.	7150 at 1*s*. 8*d*.	*Ans.*	595*l*. 16*s*. 8*d*.
76.	596 at 2*s*. 6*d*.	—	71*l*. 2*s*. 6*d*.
77.	525 at 3*s*. 4*d*.	—	87*l*. 10*s*.
78.	438 at 6*s*. 8*d*.	—	146*l*.
79.	392 at 6*s*. 9*d*.	—	132*l*. 6*s*.
80.	438 at 8*s*. 6¾*d*.	—	187*l*. 10*s*. 4½*d*.
81.	136 at 9*s*. 2½*d*.	—	62*l*. 12*s*. 4*d*.
82.	732 at 12*s*. 7*d*.	—	460*l*. 11*s*.
83.	370 at 14*s*. 2¾*d*.	—	263*l*. 4*s*. 9¼*d*.
84.	3210 at 15*s*. 7¾*d*.	—	2511*l*. 3*s*. 1½*d*.

VI. *When the price of* 1 *cwt. yd. &c. is pounds, or pounds shillings, &c.*

RULE—Multiply the given quantity by the pounds, and take parts for the shillings, &c. or, reduce the pounds and shillings into shillings, then, multiply the quantity by the shillings, take parts for the rest, add them together and divide by 20.

EXAMPLES.

85.	120 at 4*l*.	*Ans.*	480*l*.
86.	142 at 7*l*.	—	994*l*.
87.	127 at 1*l*. 3*s*. 4*d*.	—	148*l*. 3*s*. 4*d*.
88.	327 at 1*l*. 7*s*. 6*d*.	—	449*l*. 12*s*. 6*d*.
89.	536 at 1*l*. 17*s*. 6*d*.	—	1005*l*.
90.	2104 at 5*l*. 3*s*.	—	10835*l*. 12*s*.
91.	7156 at 5*l*. 6*s*.	—	37926*l*. 16*s*.
92.	2157 at 3*l*. 15*s*. 2¼*d*.	—	8108*l*. 19*s*. 5¼*d*.
93.	2157 at 2*l*. 7*s*. 4½*d*.	—	5109*l*. 7*s*. 10½*d*.
94.	95 at 15*l*. 14*s*. 7¼*d*.	—	1494*l*. 7*s*. 4¼*d*.

VII. *When the price and quantity given are of several denominations.*

RULE—Multiply the price, by the integers in the given quantity, and for the lower denominations, take parts, them together, and the sum will be the answer.

EXAMPLES.

95. 12 cwt. 2 qrs. 14 lb. of sugar at 3*l.* 14*s.* per cwt.

qrs.	*lb.*		£.	*s.*	*d.*		*cwt.*	*qrs.*	*lb.*
2	0	½	3	14	0				
					12				
			44	8	0	= price of	12	0	0
0	14	¼	1	17	0	= price of	0	2	0
			0	9	3	= price of	0	0	14
Ans.			£46	14	3	= price of	12	2	14.

96. 16 cwt. 2 qrs. at 2*l.* 6*s.* 11*d.* per cwt. *Ans.* 38*l.* 14*s.* 1½*d.*

97. 48 cwt. 2 qrs. 7 lb. at 74*l.* 16*s.* 6*d.* per cwt.
Ans. 3633*l.* 13*s.* 9½*d.*

98. 23 cwt. 0 qrs. 18 lb. at 4*l.* 14*s.* 1½*d.* per cwt. *Ans.* 109*l.*

99. 12 cwt. 1 qr. 17 lb. at 4*l.* 4*s.* 4*d.* per cwt.
Ans. 52*l.* 5*s.* 10½*d.*

100. 72 cwt. 3 qrs. 19 lb. at 3*l.* 17*s.* 4½*d.* per cwt.
Ans. 282*l.* 2*s.* 1¾*d.*

101. 7 cwt. 3 qrs. 18 lb. at 17*s.* 6*d.* per cwt. *Ans.* 6*l.* 18*s.* 5½*d.*

102. 17 lb. at 3*l.* 5*s.* 4*d.* per cwt. *Ans.* 9*s.* 11*d.*

103. 24 lb. at 4*l.* 17*s.* per cwt. *Ans.* 1*l.* 0*s.* 9½*d.*

104. 420 oz. 15 dwts. 16 grs. at 3*l.* 16*s.* 10½*d.* per oz.
Ans. 1617*l.* 7*s.* 8½*d.*

105. 19 ton, 19 cwt. 3 qrs. 27½ lb. at 19*l.* 19*s.* 11¾*d.* per ton.
Ans. 399*l.* 19*s.* 5¾*d.*

106. 9 ton 19 cwt. 3 qrs. 27¾ lb. at 39*l.* 19*s.* 11½*d.* per ton.
Ans. 399*l.* 19*s.* 5¾*d.*

107. 476 acres, 3 roods, 28 per. at 3*l.* 7*s.* 11*d.* per acre.
Ans. 1619*l.* 11*s.* 1¾*d.*

VIII *When the price of* 1 *lb. cwt. &c. is in federal money, or in pounds, and the lower denominations reduced to decimal parts.*

RULE—Multiply the price by the integers in the quantity, and for the lower denominations, if any, take parts of the price, or reduce them to decimals of the integer, and work as in Multiplication of Decimals.

EXAMPLES.

108. 13 lb. 10 oz 12 dwt. 8 grs. at $10 50 cts. per lb.
Ans. $145 78 *cts.* 9.5*m.*

109. 26 cwt. 2 qrs. 7 lb. at 15*s.* 6*d.* per cwt.
Ans. 20*l.* 18*s.* 4.3125*d.*

110. 20 ton, 19 cwt. 3 qrs. 14 lb. at 19*l.* 19*s.* 6*d.* per ton.
Ans. 419*l.* 7*s.* 0.0375*d.*

cwt. 2 qrs. 15 lb. at 1*l.* 1*s.* 4*d.* per cwt.
Ans. 29*l.* 9*s.* 6¼*d.*

112. 80 lb. 10 oz. at 3*l.* 6*s.* 5*d.* per lb. *Ans.* 267*l.* 14*s.* 10*d.*
113. 144 cwt. 2 qrs. 21 lb. at 3*l.* 17*s.* 6*d.* per cwt.
Ans. 560*l.* 13*s.* 3.375*d.*
114. 73 ton, 17 cwt. 2 qrs. at 9*l.* 12*s.* 10*d.* per ton.
Ans. 712*l.* 5*s.* 6.75*d.*
115. 17 ton, 16 cwt. 3½ qrs. at $45 75 cts. per ton,
Ans. $816.3515625.
116. 21 lb. 14 oz. 10½ drs. at $9 25 cts. per lb.
Ans. $203.18564453125.
117. 13 lb. 9 oz. 2 dwts. 13 grs. at $17 77¾ c. per oz.
Ans. $2935.73190625.
118. 42 acres, 1 rood, 16 per. at $8 20 c. per acre,
Ans. $347 27 c.
119. 80 acres, 3 roods, 30 per. at $2 25 cts. per acre.
Ans. $182 10 c. 9.375 *m.*
120. 21 yards, 1 qr. 2 nails, at 42 cts. per yard.
Ans. $10 65 c. 7.5 *m.*
121. 13 gross, 9 doz. 3 art. at $2 40 cts. per gross.
Ans. $33 5 c.

BILLS OF PARCELS, &c. FOR EXERCISE.

Albany, August 24th, 1808.

122. MR. CHEESEMONGER,

Bought of JOHN FARMER.

17 cheeses,	5 c. 2 qrs. 24 lb. at 3*l.* 14*s.* 8*d.* per cwt.			£
14 ditto,	4 c. 2 qrs. 10 lb. at 3*l.* 5*s.* 0*d.*	—		,,
14 ditto,	5 c. 1 qr. 18 lb. at 1*l.* 16*s.* 0*d.*	—		,,
21 ditto,	7 c. 2 qrs. 0 lb. at 2*l.* 11*s.* 0*d.*	—		,,
19 ditto,	6 c. 1 qr. 17 lb. at 2*l.* 9*s.* 4*d.*	—		,,
				£80 16 1.

123. J—— O——Esq.

1808. TO JAMES TEA, DR.

July 20.	2 lb. good Hyson Tea,	at 12*s.* per lb.		£
Aug. 14.	3 lb. Hyson	— at 10*s.*	—	,,
Sept. 28.	4 lb. good Green	— at 8*s.*	—	,,
Oct. 26.	5 lb. Green	— at 7*s.* 10*d.*	—	,,
Nov. 27.	6 lb. fine Bloom	— at 12*s.*	—	,,
Dec. 31.	7 lb. Bloom	— at 10*s.*		,,
				£13 —

124. Mrs. J—— C——,

1808. To John Leghorn, Dr.

Aug.	8.	2 lb. mutton chops, at 4½*d.* per lb.		£
—	9.	6 lb. leg of mutton, at 4½*d.*	—	,,
—	—	2 lb. rump steaks, at 6*d.*	—	,,
—	10.	7 lb. shoulder of mutton, at 4¾*d.*	—	,,
—	11.	9 lb. leg of pork, at 4*d.*	—	,,
—	—	5 lb. veal outlets, at 5*d.*	—	,,
				£0 11 8¾.

125. Mr. F—— T——,

1808. To Peter Goodwyn, Dr.

Jan.	8.	3 quarters wheat, at 5*l.* per qr.		£
—	11.	9 bushels barley, at 2*l.* 14*s.*	—	,,
—	—	1 quarter Oats, at 5*s.* 1½*d.* per bushel,		,,
—	13.	19 bushels beans, at 2*l.* 6*s.* per quarter,		,,
—	27.	17 lb. of hops, at 4*l.* per cwt.		,,
Feb.	1.	5 loads of hay, at 5*l.* 8*s.* per load,		,,
				£53 3 1½

126. Messrs. H—— H——, & Co.

1808. To Charles Swan & Sons.

Jan.	1.	17½ yards fustian, at 62½ cts. per yard,		$
Feb.	11.	13½ yards corduroy, at $1 12½ c.	—	,,
Mar.	12.	29½ yards forest cloth, at $1 87½ c.	—	,,
Apr.	12.	59½ yds. velvateen cord, at $1 37½ c.	—	,,
May	14.	75½ yds. German serge, at $1 10 c.	—	,,
June	17.	98½ yds. superfine cloth, at $7 25 c.	—	,,
				$959.20.

127. Messrs. S—— & W——,

1808. To William & John Hardy, Dr.

Jan.	8.	10 cwt. 2 q. 14 lb. of iron, at $112 per ton,		$
Feb.	18.	3 ton, 12 cwt. of ditto, at $116½	—	,,
Mar.	19.	5 ton, 19½ cwt. of ditto, at $115	—	,,
Apr.	20.	2 ton, 10 cwt. of pig iron, at $28	—	,,
May	21.	4 ton, 5 cwt. of ditto, at $30	—	,,
June	18.	1 ton 17½ cwt. of ditto, at $29 75 c.	—	,,
				$1419.30625.

128. Messrs. W——, G——, & S——,
1808. Bought of E. & E. H——.

Aug. 23.	4 quarto bibles, at $6¾ each,	$
—	7 doz. Webster's spel. book, at $2¼ per doz.	,,
—	6 Entick's spel. dictionary, at 60 cts. each,	,,
—	3 gross of toy books, at $3 per gross,	,,
—	5 reams wrapping paper, at $1¼ per ream,	,,
	2000 quills, at $13 per 1000,	,,
		$89.35.

129. Mr. John Pickard,
1808. Bought of William Wheatley.

March 7.	27 gal. of old mountain at $2 75 c. per gal.		$
— 14	— old sherry, at $1 50 cts.	—	,,
— 3	— Madeira, at $3 62½ cts.	—	,,
— 37	— red port, at $1 60 cts.	—	,,
— 5	— white ditto, at $1 75 cts.	—	,,
— 21	— Lisbon, at $1 40 cts.	—	,,
			$203.475

130. Mr. W—— C——,
1808. Bought of J—— D——.

May 2.	6 men's plain black hats, No. 1, at 42*s.* per hat,		£
— 6	coloured do. 2, at 36*s.*	—	,,
— 4	do. 3, at 33*s.*	—	,,
— 4	do. 4, at 30*s.*	—	,,
— 4	do. 10, at 16*s.* 6*d*	—	,,
— 12	do. 11, at 15*s.*	—	,,
— 10 boys	do. 12, at 13*s.* 6*d*	—	,,
			£55 1 0
	Trunk and Rope,		1 8 6
			£56 9 6

TARE AND TRET.

Gross is the whole weight of any sort of goods, together with the box, bag, barrel, hogshead, &c. which contains them.

Tare is an allowance, made to purchasers, for the weight of the box, bag, barrel, &c. in which goods are packed, and is either at so much in the gross, at so much per box, bag, barrel, &c. or at so much per cent or hundred weight.

Tret is an allowance of 4 lb. in every 104 lb. for waste, dust, &c.

Cloff is an allowance of 2 lb. upon every 3 cwt.

Suttle is when part of the allowance is deducted.

Neat weight is what remains after all allowances are made.

I. *When the tare is so much on the gross weight.*

RULE—Subtract the tare from the gross, and the remainder is the neat.

EXAMPLES.

1. Suppose a factor in the West Indies buys for the use of his employer in New-York, the three following hogsheads of sugar: Required their neat weight?

No.	*cwt.*	*qrs.*	*lb.*		*lb.*	
1.	16	1	14	gross	114	tare.
2.	14	3	7		110	
3.	15	2	21		116	

Ans. 43*cwt.* 3*qrs.* 10*lb. neat.*

2. A grocer buys 54 chests of spice, each chest weighing 4 cwt. 2 qrs. 14 lb. gross; tare on the whole 21 cwt. 3 qrs. 18 lb. required the neat weight. *Ans.* 227*cwt.* 3*qrs.* 10*lb.*

3. What is the neat weight of 38 hogsheads James River tobacco, weighing gross 417 cwt. 1 qr. 12 lb. tare on the whole 3982 lb? *Ans.* 381 *cwt.* 3 *qrs.* 6 *lb.*

II. *When the tare is at so much per box, bag, barrel, &c.*

RULE—Multiply the number of boxes, &c. by the tare, and subtract the product from the gross, the remainder is the neat.

EXAMPLES.

4. In 30 bales of silk, each weighing 317 lb. gross, tare per bale 14 lb. how many pounds neat? *Ans.* 7050*lb.*

5. What is the neat weight of 7 frails of raisins, each weighing 3 cwt. 3 qrs. 10 lb. gross, tare at 24 lb. per frail? *Ans.* 25 *cwt.* 1 *qr.* 14 *lb.*

6. What is the neat weight of 14 bags of cotton, each weighing 2 cwt. 2 qrs. 7 lb. tare at 9 lb. per bag? *Ans.* 34*cwt.* 3*qrs.*

III. *When the tare is at so much per cwt.*

RULE—Divide the gross by the aliquot parts of a cwt. to find the tare, and that subtracted from the gross, leaves the neat weight; or multiply the gross by the tare per cwt. and divide the product by 112, the quotient is the tare, which subtract from the gross, the remainder is the neat.

EXAMPLES.

7. What is the neat weight of 27 barrels of potash, each weighing 302 lb. gross, tare 12 lb. per cwt? *Ans.* 7280$\frac{40}{112}$ *lb.*

he neat weight of 45 barrels of figs, each 2cwt. re 14 lb. per cwt? *Ans.* 108 cwt. 1 qr. 3$\frac{1}{2}$6.

9. What is the neat weight of 40 barrels of anchovies, each 33 lb. gross, tare 10 lb. per cwt? *Ans.* $1202\frac{16}{113}$ *lb.*

IV. *When tret is allowed with tare.*

RULE—Subtract the tare, and divide the suttle by 26, the quotient is the tret, which subtract from the suttle, the remainder is neat weight.

EXAMPLES.

10. In 836 cwt. 2 qrs. 17 lb. gross, tare 22 lb. per cwt. tret 4 lb. per 104 lb. what is the neat weight?
Ans. 646 *cwt.* 1 *qr.* 23 *lb.*

11. In 17 cwt. 3 qrs. 12 lb. gross, tare 68 lb. tret 4 lb. per 104 lb. how much neat weight? *Ans.* 16 *cwt.* 2 *qrs.* 2 *lb.*

12. In 354 cwt. 1 qr. 16 lb. gross, tare 9 lb. per cwt. tret 4 lb. per 104 lb. required the neat weight?
Ans. 313 *cwt.* 1 *qr.* 16 *lb.*

V. *When cloff is allowed with tare and tret.*

RULE—Subtract the tare and tret, and divide the suttle by 168, the quotient will be the cloff, which subtract from the suttle, the remainder is neat.

EXAMPLES.

13. What is the neat weight of 139 cwt. 1 qr. 22 lb. gross, tare 8 lb. per cwt. tret 4 lb. per 104 lb. and cloff 2 lb. per 3 cwt. *Ans.* 123 *cwt.* 3 *qrs.* $1\frac{3}{4}$ *lb.*

14. In 9 cwt. 3 qrs. 14 lbs. gross, tare $17\frac{1}{2}$ lb. per cwt. tret 4 lb. per 104 lb. cloff 2 lb. per 3 cwt. how much neat?
Ans. 7 *cwt.* 3 *qrs.* $24\frac{1}{2}$ *lb.*

15. Six hogsheads contain in all 55 cwt. and 26 lb. gross; tare 30 lb. per hogshead, tret 4 lb. per 104 lb. and cloff 2 lb. per 3 cwt. what will be the neat weight?
Ans. 51 *cwt.* 1 *qr.* $0\frac{3}{4}$ *lb.*

SIMPLE INTEREST.

Interest is the premium allowed for the loan of money. The sum lent is called the Principal.

The principal and interest added together is the amount.

The rate of interest is the sum agreed upon between the borrower and lender, to be paid for every £100 or dollars for 1 year.

Interest is also applied to Commission, Brokage, &c. &c.

The principal, rate and time given to find the interest, &c.

RULE—Multiply the principal by the rate per cent, the product again by the time either in years, months, week

days, and this last product divided by 100 when the time is in years, by 100×12 when in months, by 100×52 when in weeks, and by 100×365 when in days. The quotient will be the interest, which added to the principal is the amount.

EXAMPLES.

1. What is the interest of 230*l.* 10*s.* for 1 year at 6 per cent? *Ans.* 13*l.* 16*s.* 7$\frac{20}{100}$.

2. What is the interest of $789 for 1 year at 7 per cent? *Ans.* $55 23 *cts.* 4

3. What is the interest of $1345 for 1 year at 6 per cent? *Ans.* $80 70 *cts.*

4. Find the interest of 211*l.* 5*s.* for 1 year, at 7 per cent? *Ans.* 14*l.* 15*s.* 9*d.*

5. Cast up the interest of 344*l.* 17*s.* 6*d.* for 5 years at 6 per cent. per annum? *Ans.* 103*l.* 9*s.* 3*d.*

6. Required the interest of 550*l.* for 4 years at 7 per cent. per annum? *Ans.* 154*l.*

7. Tell me the interest of $619 20 cts. for 5 years at 6 per cent. per annum? *Ans.* $185 76 *cts.*

8. What will 584\frac{1}{2}$ amount to in 3 years at 6 per cent. per annum? *Ans.* $689 51$\frac{1}{2}$ *cts.*

9. What is the amount of 440*l.* for 7 years at 7 per cent. per annum? *Ans.* 655*l.* 12*s.*

10. What sum will 567*l.* 10*s.* amount to in 9 years at 6 per cent. per annum? *Ans.* 873*l.* 19*s.*

11. What is the interest of 584*l.* 6*s.* 8*d.* for 3$\frac{3}{4}$ years at 6 per cent. per annum? *Ans.* 131*l.* 9*s.* 6*d.*

12. What is the interest of 438*l.* 14*s.* 6*d.* for 12$\frac{1}{2}$ years at 6 per cent. per annum? *Ans.* 329*l.* 0*s.* 10$\frac{1}{2}$*d.*

13. What is the interest of 317*l.* 16*s.* for 5$\frac{3}{4}$ years, at 7 per cent. per annum? *Ans.* 127*l.* 18*s.* 3*d.* 1$\frac{92}{100}$ *qrs.*

14. What will be the interest of 172*l.* 10*s.* for 7 months, at 7 per cent. per annum? *Ans.* 7*l.* 0*s.* 10$\frac{1}{2}$*d.*

Note—When the rate is 6 per cent. multiply the principal by half the number of months, and divide by 100, will also give the answer.

15. What will I have to pay for the use of $3020 for 5$\frac{1}{2}$ months, at 6 per cent. per annum? *Ans.* $83 5 *cts.*

16. The interest of 351*l.* 1*s.* for 9$\frac{3}{4}$ months, at 6 per cent. per annum, is required? *Ans.* 16*l.* 13*s.* 7*d.* 3$\frac{89}{100}$ *qrs.*

17. What is the interest of $712 for 5 weeks, at 6 per cent. per [illegible]m? *Ans.* $4 10$\frac{40}{52}$ *cts.*

18. What is the interest of 126*l.* 12*s.* for 16 weeks, at 6 per cent per annum? *Ans.* 2*l.* 6*s.* $9\frac{664}{5200}$*d.*

19. What is the amount of 500*l.* for 20 weeks, at 7 per cent per annum? *Ans.* 513*l.* 9*s.* 2*d.* $3\frac{4}{53}$*qrs.*

20. What is the interest of 378*l*, 3*s.* $8\frac{1}{2}$*d.* for 275 days, at 6 per cent per annum? *Ans.* 17*l.* 1*s.* $11\frac{1925}{36500}$*d.*

NOTE—When the rate of interest is 5 per cent, multiply the principal by the days, and divide the product by 7300; for any other rate take parts. Hence,

divide any principal by $\left\{\begin{matrix}73\\100\end{matrix}\right.$ will quote the interest at 5 per cent for $\left\{\begin{matrix}100\\73\end{matrix}\right.$ days. For any other rate and time take parts

21. How much is the interest of 150*l.* 15*s.* 6*d.* for 53 days, at 7 per cent per annum? *Ans.* 1*l.* 10*s.* 7*d.* $3\frac{5524}{36500}$*qrs.*

22. What will be the interest on 133*l.* 6*s.* 8*d.* from the 3d of April to the 25th of February at 7 per cent. per annum?
Ans. 8*l.* 7*s.* 8*d.* $3\frac{264}{365}$*qrs.*

23. How much is the interest of 133*l.* 6*s.* 8*d.* from the 10th of May to the 30th of August at 6 per cent. per annum?
Ans. 2*l.* 9*s.* $1\frac{55}{365}$*d.*

24. How much is the interest of $700 for 1 year and 73 days at 6 per cent. per annum? *Ans.* $50 40 *cts.*

25. What is the interest of 371*l.* for 1 year and 213 days, at 6 per cent. per annum? *Ans.* 35*l.* 5*s.* $0\frac{720}{36500}$*d.*

26. Let us suppose a bill of 170*l.* was due in England Aug. 12th, that 54*l.* was paid on Sept. 18th. 56*l.* on Oct. 17th and the balance on Nov. 14th. Required the interest due?
Ans 1*l.* 11*s.* $0\frac{1}{2}$*d.*

COMMISSION.

RULE—As in Simple Interest.

EXAMPLES.

1. A factor in London buys, and ships off to his employer in Philadelphia, goods to the value of 1745*l*, 12*s.* 9*d.* what is the commission at 5 per cent? *Ans.* 87*l.* 5*s.* 7*d.* 2.6*qrs.*

2. A factor buys and ships off for his employer, goods to the value of 7864*l.* 16*s.* 8*d.* what will his commission come to at $2\frac{1}{2}$ per cent? *Ans.* 196*l.* 12*s.* 5*d.*

3. A factor ships off by his employer's order, goods to the value of $753 $62\frac{1}{2}$ cents. What will his commission at 2 per cent. amount to? *Ans.* $15 $7\frac{1}{4}$ *cts.*

4. A factor ships off for his employer goods to the value of 1629*l.* 4*s.* $3\frac{1}{2}$*d.* What will be the amount of his bill including commission at 5 per cent? *Ans.* 1710*l.* 13*s.* 6*d.*

5. A. B's sales per the Jupiter amount to 675*l.* 18*s.* 8*d.* What is the commission at 8 per cent?

Ans. 54*l.* 1*s.* 5*d.* 3.68 *qrs.*

6. If a merchant of Albany, grant a draft on New-York for $4835, and be allowed $1\frac{1}{8}$ per cent in name of premium or commission; what will that amount to?

Ans. $66 $48\frac{1}{8}$ *cts.*

BROKERAGE, OR BROKAGE.

RULE—As in Simple Interest.

EXAMPLES.

1. What brokerage must a factor pay to his broker for selling a cargo of sugar amounting to $11210 at $\frac{1}{8}$ per cent?

$$\frac{11210\times3}{100\times8} = \$42\ 3\tfrac{3}{4}\ cts.\quad Ans.$$

2. What is the brokerage on $784 at $\frac{5}{8}$ per cent?

Ans. $4 90 *cts.*

3. What is the brokerage on 476*l.* 12*s.* 9*d.* at 6*s.* 8*d.* per cent?

Ans. 1*l.* 11*s.* 9*d.* $1\frac{24}{100}$ *qrs.*

4. What will the brokage on 834*l.* 18*s.* 4*d.* come to at 5*s.* 6*d.* per cent?

Ans. 2*l.* 5*s.* 11*d.* $0\frac{13}{100}$ *qrs.*

PURCHASING OF STOCKS.

RULE—As in Simple Interest.

EXAMPLES.

1. What is the purchase of $2550 funded stock at $98\frac{1}{2}$ per cent?

Ans. $2511 75*c.*

2. What is the purchase of 575*l.* 10*s.* stock at $131\frac{3}{4}$ per cent?

Ans. 758*l.* 4*s.* 5*d.*

3. What sum will purchase $800 stock at $124\frac{7}{8}$ per cent?

Ans. $990.

4. Required the sum that will purchase $4039 stock at 94 per cent?

Ans. $3796 $66\frac{2}{3}$ c.

REBATE AND DISCOUNT

Is an allowance made for the payment of money before it becomes due, and is less than interest by the interest of the interest for the given time.

The present worth of any sum is such, that if put to interest at the given rate per cent. would amount in the time ual to the sum.

I. *Given, the sum to be discounted, rate per cent. and time, to find the discount.*

RULE—As the amount of 100*l.* or dollars, for the given rate and time: is to the interest of 100*l.* or dollars, for that time: : So is the given sum: to the discount.

EXAMPLES.

1. What is the discount of 570*l.* due 2 years hence, at 7 per cent. per annum. *Ans.* 70*l.*

2. How much is the discount of $530, due in 9 months, at 8 per cent. per annum? *Ans.* $30.

3. How much is the rebate of 308*l.* 15*s.* in 21 months, at 8 per cent. per annum? *Ans.* 37*l.* 18*s.* 4*d.*

4. How much is the rebate of 45*l.* 15*s.* 6*d.* for 1 year, at 6 per cent? *Ans.* 2*l.* 11*s.* 9*d.* $3\frac{42}{106}$ *qrs.*

II. *Given, the sum to be discounted, rate per cent. and time, to find the present worth.*

RULE—As the amount of 100*l.* or dollars, for the given rate and time: is to 100*l.* or dollars: : So is the given sum: to the present worth.

EXAMPLES.

5. What is the present worth of $1134, payable in 12 months at 6 per cent. per annum?

Ans. $1035 $61\frac{705}{1095}$ *cts.*

6. Required the present worth of 795*l.* 11*s.* 2*d.* due in 11 months, at 6 per cent. per annum?

Ans. 754*l.* 1*s.* 8*d.* $0\frac{260}{2253}$ *qrs.*

7. A merchant is indebted $2163 15 cts. payable in 12 months. I demand what sum will discharge the debt, if he pay it at the expiration of 5 months, discounting at the rate of 6 per cent. per annum? *Ans.* $2090.

8. A merchant owes $110, payable in 20 months, and $224, payable in 24 months, the first sum he pays in 5 months, and the other one month after that, discounting at the rate of 8 per cent. per annum. I demand the sum he paid? *Ans.* $300.

9. A. is indebted to B. $432, payable in 1 year, and $580, payable in 2 years; now as B. wants money immediately and is willing to allow A. a discount of 8 per cent. per annum. I demand the sum that would be required to discharge A's debt to B.? *Ans.* $900.

BANK DISCOUNT.

Banks, consider the sum expressed in the note or bill, as a *principal on which* they calculate interest from the ti

is discounted until due, and they moreover only recken 30 days to the month, this makes the interest $\frac{5}{365}$ or $\frac{1}{73}$ part more than the true.

1. *To find the interest or bank discount for 60 days, at 6 per cent. per annum.*

RULE—As 100×360 : 6 per cent. : : principal×60 : interest, hence, 100×360÷6×60=100 the divisor for any sum at 6 per cent. per annum for 60 days.

N. B. When the time is less or more than 60 days, take parts which add or subtract.

EXAMPLES.

1. What bank discount must be charged on a note of $1152, at 6 per cent? $1152÷100=$11 52 *cts. Ans.*

2. What discount must I pay at the bank on a note of $705 50 cts. at 6 per cent? *Ans.* $7 5½ *cts.*

3. How much will I receive at the bank for Q. R. & Co's. note of $817 25 cts. due in 60 days? *Ans.* $809 7¾ *cts.*

4. What credit will I get at the bank for F. G. & H's. note of $2071, due 60 days hence? *Ans.* $2050 29 *cts.*

5. What will be the discount on $510, 42 days to run, at 6 per cent. per annum?

	$. c.	
	5.10	interest or bank discount for 60 days.
30 days=½=	2.55	ditto for 30 days.
12 days=⅕=	1.02	ditto for 12 days.
Answer,	$3.57	ditto for 42 days.

6. Discounted at the State Bank J. & F. promissory note for $925, 50 days to run; also D. W. & Co's. for $1181, 56 days to run. What sum may I draw for, and reserve $817 75 cts. to pay my note in favor of J. & A. K. due in 8 days? *Ans.* $1269 51$\frac{9}{16}$ *cts.*

7. How much is the discount on $519, due in 72 days, at 6 per cent. per annum?

	$. cts.	
	5.19	discount for 60 days.
12 days=⅕=	1.03.8	ditto for 12 days.
		— days.
Answer,	$6.22.8	ditto for 72 days.

8. Deposited in the bank $800 in cash, A. B. & Co's. promissory note for $1324, due in 3 days; also for discount S. & O's. promissory note for $783, 63 days to run, and T. M's. for $1113, 66 days to run: How will the account stand after the following checks, viz: to W. C. for $592, to R. & M. for 213\frac{34}{100}$, to G. R. for 945\frac{84}{100}$, and to H. G. for 611\frac{33}{100}$ are paid by the bank? *Ans. in bank* $1637 10c. 5½ *m.*

II. *To find the interest or bank discount at 4, 5, 7 and 8 per cent.*

RULE—Find the discount at 6 per cent. as before; subtract $\frac{1}{5}$ for 5, and $\frac{1}{5}$ for 4 per cent; and add $\frac{1}{5}$ for 7, and $\frac{1}{5}$ for 8 per cent; the remainder or sum will be the discount.

EXAMPLES.

9. What would be the interest or bank discount, on $625, for 72 days at 5 per cent. per annum?

6.25 interest for 60 days, at 6 per cent.
12 days $=\frac{1}{5}=$ 1.25 ditto, for 12 days, at 6 per cent.

$7.50 ditto, for 72 days, at 6 per cent.
Subtract $\frac{1}{6}$ part 1.25

Answer, $6.25 ditto, for 72 days, at 5 per cent.

10. Required the interest on $972 for 80 days 7 per cent. per annum? *Ans.* $15 12 *cts.*

11. What is the interest on $1320 for 76 days, at 5 per cent. per annum? *Ans.* $13 93$\frac{1}{3}$ *cts.*

12. Tell me the interest on $1076 for 55 days, at 4 per cent. per annum? *Ans.* $6 57$\frac{5}{9}$ *cts.*

13. Cast up the interest on $96 for 68 days at 8 per cent. per annum? *Ans.* $1 45 *cts.* 0$\frac{4}{9}$ *m.*

CUSTOM-HOUSE DUTIES.

I. *When the duties are rated at so much per lb. gal. doz. &c.*

RULE—Reduce the commodity to the denomination mentioned in the duties; then multiply by the duty, the product is the answer.

EXAMPLES.

1. Required the duty on 9 cwt. 2 qrs. 14 lb. of sugar at 1 c. per lb. *Ans.* $10 78 *cents.*

2. What is the duty on 828 dozen of porter at 20 cts. per dozen? *Ans.* $165 60 *cents.*

3 What is the duty on 2 cwt. 2 qrs. 20 lb. of coffee at 2½ cts. per lb. *Ans.* $8 20 *c.*

4. What will the duties on 29 hhds. of Madeira wine amount to at 18 cts. per gallon? *Ans.* $283 50 *c.*

5. I demand the amount of duty on 5 cwt. 3 qrs. 17 lb. of cheese at 4 cents per lb. *Ans.* $26 44 *c*

II. *When the duties are rated at so much per cent.* ad valorem.

RULE—To find the *ad valorem* rates of duty on merchandise, add 20 per cent to the actual cost thereof if imported

from, or beyond the cape of Good Hope, and 10 per cent if imported from any other place, including all charges, commissions, outside packages, and insurance excepted, then by the rule for interest find the duty.

The rates at which all foreign coins and currencies are estimated at the Custom-Houses of the United States

	Dols.	Cts.
Each pound sterling of Great Britain, at - - - -	4	44
Each pound sterling of Ireland - - - - - - - - - -	4	10
Each livre tournois of France - - - - - - - - - -		18½
Each florin or gilder of the United Netherlands -		40
Each mark banco of Hamburgh - - - - - - - - -		33⅓
Each rix dollar of Denmark - - - - - - - - - - - -	1	
Each real of plate of Spain - - - - - - - - - - -		10
Each real of vellon of Spain - - - - - - - - - - -		5
Each milree of Portugal - - - - - - - - - - - - -	1	24
Each tale of China - - - - - - - - - - - - - - -	1	48
Each pagoda of India - - - - - - - - - - - - - -	1	84
Each rupee of Bengal - - - - - - - - - - - - - -		50

EXAMPLES.

6. What will be the amount of duty on a case of artificial flowers, feathers, and other ornaments for head dresses, amounting to 83*l.* 17*s.* 9*d.* sterling, the duties 15 per cent. ad val. *Ans.* $61.4559825.

7. What is the duty on the above articles if imported in a foreign vessel, the rate being 10 per cent more than an American vessel? *Ans.* $67.60158075.

8. What is the duty on an invoice of gold watches imported from Paris, the cost exclusive of commission, being 18750 livres tournois, at 15 per cent ad valorem? *Ans.* 572.34375

9. What will be the duty on the above if imported in a foreign vessel, at 16½ per cent ad valorem? *Ans.* $629.578125

10. What is the amount of duty on an invoice of cotton goods imported from the East Indies, the prime cost being 15400 pagoda, at 12½ per cent ad valorem. *Ans.* $4250.40

EQUATION OF PAYMENTS

Is when several debts are payable at different times, to find a mean time for paying the whole debt to do which the fol-
[illegible] mmon
[illegible]ly each payment by its time, and divide the
[illegible]cts by the sum of the payments; the quo-
[illegible]quated time.

EXAMPLES.

1. A. owes B. $600 to pay at 40 days, $200 at 60 days, and $200 at 120 days. When may these debts be paid at once, without injury to either party? *Ans.* 60 *days.*

2. A. bought goods of B. for £640 whereof £100 is to be paid presently, £300 at the end of 4 months, and £240 at 8 months: Required the equated time for paying the whole debt? *Ans.* $4\frac{7}{8}$ *months.*

3. William bought of Peter a quantity of goods on the following terms, viz. $\frac{1}{3}$ part cash, $\frac{1}{3}$ in 6 months, and the remaining $\frac{1}{3}$ in 8 months; but they afterwards agreed to settle the whole at one equated time, which is now required? *Ans.* $4\frac{2}{3}$ *months.*

4. Eben is indebted to Frederick £240, which by agreement is to be paid at 5 months hence; but Eben is willing to pay him £40 down, provided he will give him a longer time for the payment of the remainder, which is agreed on: Required the time of payment? *Ans.* 6 *months.*

BARTER.

Barter, teaches merchants to exchange goods of different prices and quantities, so as to receive no loss by such truck or change.

I. *When the quantity of one commodity is given with its value, to find an equivalent quantity of another commodity at its proposed value.*

RULE—As the value of the given quantity: is to the given quantity:: so is the value of the required quantity: to the required quantity.

EXAMPLES.

1. How much tea at 7*s.* 6*d.* per lb. must be given in barter for 124 gallons of rum at 8*s.* $5\frac{1}{2}$*d.* per gallon? *Ans.* $139\frac{76}{90}$*lb.*

2. A merchant has 1000 lb. of cheese which he barters at $9\frac{1}{4}$*d.* per lb. for sugar at $10\frac{1}{4}$*d.* per lb. how much sugar must he receive? *Ans.* $926\frac{34}{41}$*lb.*

3. How much coffee at 2*s.* 3*d.* per lb. must be given in barter for 41 cwt. 2 qrs. 14 lb. of potash at 56*l.* per ton? *Ans.* 9*cwt.* 1*qr.*

4. How much brandy at $1 25 cents per gallon, must be given in barter for 96 bushels of wheat at $1 75 cts. per bush *Ans.* $134\frac{10}{125}$ gallo

II. *When the quantities of two commodities are given with the rate of selling them, to find in case of difference, what money, or how much of any other commodity must be given.*

RULE—Find the separate values of the given commodities, their difference is the money or amount of the other commodity.

EXAMPLES.

5. A. and B. barter; A. gets 20 hats, at 21*s*. 6*d*. per piece; B. gets 8 pieces of linen at 3*l*. 14*s*. per piece; what is the balance and to whom due? *Ans. balance due B.* 8*l*. 2*s*.

6. Two merchants barter; A. has 32 cwt. of cheese at $6¼ per cwt. and B. has 126 gallons of rum at 11½ cents per gallon, and the balance in rice at 8 cents per lb. What quantity of rice must A. receive from B. *Ans.* 828⅛ *lb.*

7. A. and B. would barter; A. has 273 bushels of wheat at 13*s*. per bushel, for which B. gives him a hogshead of sugar weighing 16 cwt. 1 qr. 21 lb. neat, at 86*s*. per cwt. and the balance in calico at 4*s*. 6*d*. per yard: How many yards of calico must A. receive from B? *Ans.* 474 $\frac{87}{108}$ *yds.*

III. *When one commodity is advanced above the ready money price in barter, to find what price any other article should be rated at so as to make the barter equal.*

RULE—As the ready money price of the one commodity: is to its bartering price :: So is the ready money price of the other commodity: to its bartering price.

Note—The required quantity may be found either by the ready money or bartering price.

EXAMPLES.

8. A. hath 100 yards of broadcloth at 36*s*. per yard ready money, which he barters with B. at 42*s*. for buttons worth 12*s*. per gross ready money: How many gross must A. receive, and how must B. rate them in barter, so as to be on a footing with A? *Ans.* 300 *gross, and* 14*s*. *the barter price.*

9. A. has 150 lb. of indigo which cost him 5*s*. per lb. which he barters at 5*s*. 10*d*. with B. who has wheat that cost him 12*s*. per bushel, at how much must B. charge his wheat to gain in proportion as much as A. and how many bushels is he to deliver. *Ans* 62½ *bushels at* 14*s*.

10. A. has German Osnaburghs at 32 cents per ell ready money, but in barter he will have 36 cents. B. has James River tobacco at 6 cents per lb. ready money: At what rate must B. value his tobacco to be equivalent to A's bartering price, and how many ells of Osnaburghs, must then be given [illegible] ds of B's tobacco, weighing 18135 lb. [illegible] tobacco 6¾ cts. per lb. 34002$\frac{10}{32}$ ells, *Osna.*

11. A. and B. barter; A. has 145 barrels flour at $8 per barrel, ready money, but in barter he will have 8\frac{3}{4}$: B. has salt at $1 per bushel ready money: How must B. sell his salt per bushel in proportion to A's bartering price, and how many bushels are equal to A's flour?

Ans. Barter price $1 9 *cts.* 3$\frac{1}{4}$*m.* and must give A. 1160 *bus.*

LOSS AND GAIN.

Loss and Gain is a rule by which traders calculate their profit, or loss per cent. or on the gross: It also directs them how to raise or fall the price of their goods, so as to gain, or lose any proposed rate per cent, &c.

1. *To calculate the gain or loss per cent. on goods having the prime cost and selling price given.*

RULE—Find the gain or loss by Subtraction; then say as the price it cost: is to the gain or loss: : So is 100*l.* or dollars: to the gain or loss per cent.

EXAMPLES.

1. Bought tea at 87$\frac{1}{2}$ cents per lb. which I sold at $1 per lb. what do I gain per cent?

As 87$\frac{1}{2}$: 100—87$\frac{1}{2}$: : 100 : 14$\frac{2}{7}$ per cent. *Ans.*

2. If I buy tea at $1 per lb. and sell it again at 87$\frac{1}{2}$ cents per lb. what is lost per cent? *Ans.* 12$\frac{1}{2}$ *per cent.*

3. Bought 1 cwt. of butter for 8*l.* 8*s.* which I sell again at 20*d.* per lb. what is the gain on the whole and what per cent?

Ans. { Gain on the whole 18*s.* 8*d.*
Gain per cent. 11*l.* 2*s.* 2$\frac{336}{504}$*d.*

4. A merchant bought 315 bushels of wheat at 16*s.* per bushel, and 537 bushels of ditto, at 13*s.* per bushel, and sold it, one with another, at 15*s.* per bushel: What did he gain on the whole and what per cent?

Ans. { Gain on the whole 37*l.* 19*s.*
Gain per cent. 6*l.* 6*s.* 3$\frac{4188}{18021}$*d.*

5. If a merchant gain 2$\frac{1}{4}$*d.* on a shilling, what is that per cent? *Ans.* 18*l.* 10*s.* 10*d.*

6. Bought cloth at 8*s.* per yard, ready money, which I immediately sell again at 9*s.* per yard on 6 months credit: What is the gain per cent?

	s.	*s.*	*s.*	*l.*	*l.*	*s.*		*mo.*	*l.*	*mo.*	*l.*
As	8 :	9—	8 : :	100 :	12	10.	As	12 :	6 : :	6 :	3
	l.	*l.*	*l.*	*l.*	*l.*	*s.*		*l.*	*s.*	*d.*	
As	100+3 :	100 : :		100+12	10 :			109	4	5$\frac{61}{103}$.	
				l.	*s.*	*d.*		*l.*	*s.*	*d.*	

Hence, 109 4 5$\frac{61}{103}$—100=9 4 5$\frac{61}{103}$.

7. If I buy wine at 125 cents per gallon ready money, and sell it again at 175 cents per gallon on 4 months credit: What do I gain per cent? *Ans.* $37 $25\frac{50}{102}$ *cts.*

8. If for ready money I could purchase tobacco at $6 per 100 lb. and sell it on 3 months credit, at $7 50 cts. per 100 lb. What would be my gain per cent?

Ans. $23 $15\frac{55}{203}$ *cts.*

9. Suppose I receive from Richmond, Virginia, 12 hogsheads of tobacco, weighing 15457 lb. neat, which, with the charges there, amounted to $796 85 cts. freight from thence to New-York $6 per hogshead, drayage and storage there 90 cts. per hogshead, and freight to Albany, $1 50 cts. per hogshead. What does it stand me in per 100 lb. and what will be my gain per cent. by selling it at $7\frac{1}{2}$ cts. per lb. on 5 months credit?

Ans. { Stands me in per 100 lb. $5 $86\frac{11440}{15457}$ *cts.*
{ My gain per cent. $25 $99\frac{52034125}{92009125}$ *cts.*

10. Bought 1 pipe of wine, for 50*l.* ready money, and sold it for 54*l.* 10*s.* payable in 2 months. Quere, the gain per cent. per annum.

	£.		£. s.		£.
			54 10		
			50		
	£.				£.
	50 :		4 10 :	:	100
months	2				12 months.

Ans. 54*l.*

11. Bought a house and lot at $5000, payable in 9 months, which I sold again for $5500, payable in 15 months: What is the gain per cent. per annum? *Ans.* $20.

12. What is the profit per cent. in 12 months upon 3000 lb. of coffee, which cost 25 cents per lb. ready money, and sold for 30 cents per lb. on a credit of 8 months? *Ans.* $30.

13. A tobacconist buys 21 barrels of manufactured tobacco, neat weight 30 cwt. 3 qrs. 14 lb. at $9¼ per 100 lb. ready money, and sells it for $11⅛ per 100 lb. on 4 months credit: I demand the gain per cent. per annum?

Ans. $60 $86\frac{18}{37}$ *cts.*

14. If I buy rum at 9*s.* per gallon on a credit of 4 months, and sell the same at 8*s.* per gallon, for ready money: What is the loss per cent. per annum? *Ans.* 33*l.* 6*s.* 8*d.*

II. *To calculate how goods must be sold, so as to gain or lose any proposed rate per cent.*

[illegible]*l.* or dollars: is to the price :: So is 100*l.*
[illegible] gain added, or loss subtracted, to the

EXAMPLES.

15. Bought tea at $87\frac{1}{2}$ cts. per lb. how must I sell it, so as to gain at the rate of $\$14\frac{2}{7}$ per cent?

$$\text{As } \overset{\$}{100} : \overset{cts.}{87\tfrac{1}{2}} :: \overset{\$}{100} + \overset{\$}{14\tfrac{2}{7}} : 100 \text{ cents per lb. } \textit{Ans.}$$

16. If I buy a quantity of tea at $\$1$ per lb. how must it be sold to lose $\$12\frac{1}{2}$ per cent? *Ans.* $87\frac{1}{2}$ *cts.*

17. Bought cloth at 45*s.* per yard, which I find on examination to be of inferior quality to what I expected, and must lose $17\frac{1}{2}$ per cent. by it. What will be the price per yard? *Ans.* 37*s.* $1\frac{1}{2}$*d.*

18. Bought a pipe of wine containing 126 gallons at 10*s.* per gallon, but by accident 16 gallons leaked out: At what rate must the remainder be sold per gallon, to gain upon the whole prime cost, at the rate of $12\frac{1}{2}$ per cent? *Ans.* 12*s.* $10\frac{7}{11}$*d.*

III. *When the gain or loss per cent. is given with the selling price of the commodity, to find the prime cost.*

RULE—As 100*l.* or dollars, with the gain per cent. added, or loss per cent. subtracted : is to the price : : So is 100*l.* or dollars : to the prime cost.

EXAMPLES.

19. If by selling tea at $\$1$ per lb. there is gained $\$14\frac{2}{7}$ per cent. What did the pound cost?

$$\text{As } \overset{\$}{100} + \overset{\$}{14\tfrac{2}{7}} : \overset{\$}{1} :: \overset{\$}{100} : 87\tfrac{1}{2} \textit{ cts. per lb. } \textit{Ans.}$$

20. If by selling tea at $87\frac{1}{2}$ cents per lb. there is lost $\$12\frac{1}{2}$ per cent. What did it cost per pound? *Ans.* $\$1$.

21. If 40 lb. of butter be sold at 1*s.* 6*d.* per lb. and I gain 9*l.* per cent. What did the whole cost? *Ans.* 2*l.* 15*s.* 0*d.* $2\frac{22}{109}$ *qrs.*

22. If 126 gallons of wine be sold retail at 15*s.* per gallon, whereby I gain 20*l.* per cent. What did it cost per gallon? *Ans.* 12*s.* 6*d.*

IV. *The selling price and the gain or loss per cent. being given; to find what would be the gain or loss per cent. if sold at any other price.*

RULE—As the first price : is to 100*l.* or dollars with the gain per cent. added, or loss per cent subtracted : : So is the other price : to gain or loss per cent required.

N. B. If the answer exceed 100, the excess is the gain per cent. but if less than 100, the deficiency is the loss per cent.

EXAMPLES.

23. If when tea is sold at $1 per lb. there is a gain of 14\frac{2}{7}$ per cent: What will be the gain or loss per cent. by selling it at 87$\frac{1}{2}$ cents per lb?

	cts.	$	$	cts.	$
As	100 :	100+14$\frac{2}{7}$	: :	87$\frac{1}{2}$:	100—100=0

Ans. *Neither gain nor loss.*

24. If a merchant gain 12\frac{1}{2}$ per cent. by selling salt at $1 per bushel; afterwards becoming scarce, he advances the price 12$\frac{1}{2}$ cents per bushel: What will then be his gain per cent? *Ans.* $26 56$\frac{1}{4}$ *cts.*

25. If molasses sold at 48 cents per gallon, produce $10 per cent gain: What will be the gain or loss per cent. if it is sold at 42 cents per gallon? *Ans.* 3\frac{1}{4}$ *loss.*

26. A stationer sold quills at 8*s.* 9*d.* per hundred, by which he gained $\frac{1}{6}$ of the money, he afterwards found them to be in great demand and raised them to 9*s.* 6*d.* per hundred. Required his gain per cent. by the latter price?

Ans. 26*l.* 13*s.* 4*d.*

EXCHANGE.

Exchange is the receiving or paying money in one state or country, for the like sum in another.

The par of exchange is when the sum received and paid away are of the same intrinsic value, or contain an equal quantity of pure gold or silver.

The course of exchange is the current price betwixt two places, which is fluctuating, being sometimes above and sometimes below par, according to the circumstances of trade.

INLAND EXCHANGE.

I. *To change Federal money, into the currencies of the different states.*

GENERAL RULE—As $1 : is to its value in currency : : so is the given sum in dollars : to the answer in currency.

EXAMPLE AND PARTICULAR RULES.

1. Given $625 Federal money to be changed into the currencies of the different states of

New-England, Virginia, Kentucky, Tennessee, &c. where $1 is current at 6s. } Rule. × by 3 ÷ by 10. or × by .3 *Ans.* 187*l.* 10*s.*

New-York and North Carolina, where $1 is current at 8s. } Rule. ×by 2÷by 5. or×by .4 *Ans.* £250.

[illegible]sylvania, [illegible]land, at 7s 6d } Rule. ×by 3÷by 8. *Ans.* 234*l.* 7*s.* 6*d.*

South-Carolina and Georgia, where $1 is current at 4s.8d. } Rule. ×by 7÷by 30 *Ans.* 145*l.* 16*s.* 8*d.*

II. *To change the currencies of the different states, into Federal money, and the currency of one state into that of another.*

GENERAL RULE—As the value of $1 in currency : is to $1 : : so is the given sum in currency : to the answer in dollars.

As the value of $1 in known currency : is to the value of $1 in required currency : : so is the given sum in known currency : to the answer in currency required.

EXAMPLES AND PARTICULAR RULES.

2. Given 187*l.* 10*s.* currency of New-England, Virginia, Kentucky, Tennessee, &c. where $1 is current at 6*s.* to be changed into the currency of

The United States of America, where $1 is current at 100cents. } Rule. ×by 10÷by 3. *Ans.* $625.

New-York & North-Carolina, where $1 is current at 8*s.* } Rule. × by 4 ÷ by 3. or + $\frac{1}{3}$ *Ans.* £250

New-Jersey, Pennsylvania, Delaware and Maryland, where $1 is current at 7. 6*d.* } Rule. × by 5 ÷ by 4. or + $\frac{1}{4}$ *Ans.* 234*l.* 7*s.* 6*d.*

South-Carolina and Georgia, where 1$ is current at 4*s.* 8*d.* } Rule. × by 7 ÷ by 9. or — $\frac{2}{9}$ *Ans.* 145*l.* 16*s.* 8*d.*

3. Given £250 currency of New-York and North-Carolina, where $1 is current at 8*s.* to be changed into the currency of

The United States of America, where $1 is current at 100 cents. } Rule. ×by 5÷by 2. or÷by.4 *Ans.* $625.

New-England, Virginia, Kentucky, Tennessee, &c. where $1 is current at 6*s.* } Rule. × by 3 ÷ by 4. or — $\frac{1}{4}$ *Ans.* 187*l.* 10*s.*

New-Jersey, Pensylvania, Delaware and Maryland, where $1 is current at 7*s.* 6*d.* } Rule. × by 15 ÷ by 16. or — $\frac{1}{16}$ *Ans.* 234*l.* 7*s.* 6*d.*

South-Carolina and Georgia, where $1 is current at 4*s.* 8*d.* } Rule. ×by 7÷by 12. or — $\frac{5}{12}$ *Ans.* 145*l.* 16*s.* 8*d.*

4. Given 234*l.* 7*s.* 6*d.* currency of New-Jersey, Pennsylvania, Delaware and Maryland, where $1 is current at 7*s.* 6*d.* to be changed into the currency of

The United States of America where $1 is current at 100 cts. } Rule. ×by 8÷by 3, or ×by 2$\frac{2}{3}$. *Ans.* $625.

New-England, Virginia, Kentucky, Tennessee, &c. where $1 is current at 6*s.* } Rule. ×by 4÷by 5, or ×by .8 *Ans.* 187*l.* 10*s.*

New-York and N. Carolina, where $1 is current at 8*s.* } Rule. × by16÷by 15, or + $\frac{1}{15}$ *Ans.* 250*l*

South-Carolina and Georgia, *where $1 is current at 4s. 8d.* } Rule. ×by 28 ÷ by [illegible] *Ans.* 145*l.*

5. Given 145*l.* 16*s.* 8*d.* currency of South-Carolina and Georgia, where $1 is current at 4*s.* 8*d.* to be changed into the currency of

The United States of America, where $1 is current at 100 cents. } Rule. × by 30 ÷ by 7. *Ans.* $625.

New-England, Virginia, Kentucky, Tennessee, &c. where $1 is current at 6*s.* } Rule. × by 9 ÷ by 7. *Ans.* 187*l.* 10*s.*

New-York and N. Carolina, where $1 is current at 8*s.* } Rule. × by 12 ÷ by 7. *Ans.* 250*l.*

New-Jersey, Pennsylvania, Delaware and Maryland, where $1 is current at 7*s.* 6*d.* } Rule. × by 45 ÷ by 28. *Ans.* 234*l.* 7*s.* 6*d.*

EXCHANGE WITH GREAT-BRITAIN.

In Great-Britain they keep their accounts in pounds, shillings and pence, sterling, and exchanges by the 100*l.* which is equal to 444\frac{2}{9}$ at par.

I. *To change sterling where 4s. 6d. is equal to $1, into federal money, and the currencies of the different states.*

General Rule—Say as 4*s.* 6*d.* : is to $1 : : So is the amount in sterling : to the answer in federal money.

Note—Federal money may be changed to the currency of the different states, by the rules given under the head of inland exchange.

EXAMPLES AND PARTICULAR RULES.

1. Given 125*l.* sterling, where the dollar is valued at 4*s.* 6*d.* to be changed into the currency of

The United States of America, where $1 is current at 100 cts. } Rule. × by 40 ÷ by 9. *Ans.* $555 $55\frac{5}{9}$ *cts.*

New-England Virginia, &c. where $1 is equal to 6*s.* } Rule. × by 4 ÷ by 3, or + $\frac{1}{3}$ *Ans.* 166*l.* 13*s.* 4*d.*

New-York and N. Carolina, where $1 is equal to 8*s.* } Rule. × by 16 ÷ by 9, or + $\frac{7}{9}$ *Ans.* 222*l.* 4*s.* 5*d.* $1\frac{1}{9}$ *qrs.*

New-Jersey, Pennsylvania, &c. where $1 is equal to 7*s.* 6*d.* } Rule. × by 5 ÷ by 3, or ÷ by .6 *Ans.* 208*l.* 6*s.* 8*d.*

South-Carolina and Georgia, where $1 is equal to 4*s.* 8*d.* } Rule. × by 28 ÷ by 27, or + $\frac{1}{27}$. *Ans.* 129*l.* 12*s.* $7\frac{1}{9}$.

II. *To change federal money into sterling, where the dollar is equal to 4s. 6d.*

Rule—As $1 : is to 4*s.* 6*d.* : : So is the federal money : to the answer, or × by 9 ÷

EXAMPLES.

2. Given $555 55$\frac{5}{9}$ cts. federal money, to be changed into sterling, where the dollar is equal to 4*s*. 6*d*. *Ans.* 125*l*.

3. Given $371 75 cts. federal money: Required its equivalent amount in sterling? *Ans.* 83*l*. 12*s*. 10$\frac{1}{2}$*d*.

III. *To change the currencies of the different states, into sterling, where the dollar is equal to 4s. 6d.*

General Rule—Say, as the currency equal to $1: is to 4*s*. 6*d*. sterling:: So is the given amount in currency: to the answer in sterling.

EXAMPLE AND PARTICULAR RULES.

4. In sterling money, I demand the amount of

100*l*. currency of the states of New-England, Virginia, &c. where the dollar is current at 6*s*	Rule.	×by 3 ÷ by 4, or —$\frac{3}{4}$. *Ans.* 75*l*.
100*l*. currency of New-York, and North-Carolina, where the dollar is current at 8*s*.	Rule.	× by 9 ÷ by 16. *Ans.* 56*l*. 5*s*.
100*l*. currency of New-Jersey, Pennsylvania, Delaware & Maryland, where the $ is at 7*s*. 6*d*.	Rule.	×by 3÷by 5, or ×by .6 *Ans.* 60*l*.
100*l*. currency of South-Carolina and Georgia, where the dollar is current at 4*s*. 8*d*.	Rule.	×by 27÷by 28, or—$\frac{1}{28}$ *Ans.* 96*l*. 8*s*. 6*d*. 3$\frac{4}{7}$ *qrs*.

IV. *To change English Guineas into federal money.*

Rule—Multiply the given amount in guineas by 14, and divide that product by 3: the quotient will be the answer in federal money.

EXAMPLE.

5. Given 162 guineas, to be changed into federal money: Required the amount? *Ans.* $756.

V. *To change federal money into guineas.*

Rule—Multiply the given amount in federal money by 3, and divide that product by 14, the quotient will be the answer.

EXAMPLE.

6. Given $756 to be changed into guineas: Required the amount? *Ans.* 162.

A Table of Rates, and corresponding Ratio's for calculating Exchange above or below par.

Rate	0.	¼	½	¾.
0.	...	1.0025	1.005	1.0075
1.	1.01	1.0125	1.015	1.0175
2.	1.02	1.0225	1.025	1.0275
3	1.03	1.0325	1.035	1.0375
4.	1.04	1.0425	1.045	1.0475
5.	1.05	1.0525	1.055	1.0575
6.	1.06	1.0625	1.065	1.0675
7.	1.07	1.0725	1.075	1.0775
8.	1.08	1.0825	1.085	1.0875
9.	1.09	1.0925	1.095	1.0975
10.	1.1	1.1025	1.105	1.1075
11.	1.11	1.1125	1.115	1.1175
12	1.12	1.1225	1.125	1.1275

Rules. For using the Table.

I. By the ratio for the rate, multiply the amount of the bill when the exchange is above par, and the product will be the value of the bill.

II. By the ratio for the rate, divide the amount of the bill when the exchange is below par, and the quotient will be the value of the bill.

EXAMPLES.

7. If I draw on London for 720*l.* sterling, and negotiate my bill at 4¾ per cent above par, what have I to receive in federal money? $\frac{720\times1.0475\times40}{9}=\$3352$ *Ans.*

8. Bought a bill of exchange drawn on Glasgow, payable in London for 936*l.* sterling, 4 per cent below par, what sum have I to pay in federal money? $\frac{936\times40}{9\times1.04}=\$4000.$ *Ans.*

9. Suppose a factor to owe his merchant in Britain, neat proceeds amounting to $9645, required the amount of the sterling bill for that sum, admitting the remittance to be made at an exchange 5 per cent below par?

$\frac{9645\times1.05\times9}{40}=2278l.\ 12s.\ 7\frac{1}{2}d.$ *Ans.*

10. Having received $4912⅔ for my draft of 1089*l.* sterling on London, for the neat proceeds of a consignment of potash, at what exchange did I negotiate my bill?

$\frac{4912.6\times9}{1089\times40}=1.015=1\frac{1}{2}$ per cent above par. *Ans.*

11. Admit that I buy a bill of exchange on London for 468*l.* [illegible]nt below par, which I remit to my agent, [illegible]rwards, I valued on him for the same at an [illegible] above par: quere my gain in federal money?

Ans. $143 78 $\frac{26}{103}$ cents.

EXCHANGE WITH IRELAND.

In Ireland the money of account is the same as in England, but different in value. The par between England and Ireland is 8⅓ per cent. Hence, 100*l.* sterling, is equal to 108*l.* 6*s.* 8*d.* Irish currency.

The United States dollar, is equal to 4*s.* 10½*d.* Irish.

I. *To change the currency of Ireland into that of the United States.*

RULE—Multiply the Irish currency by 160, and divide the product by 39, the quotient will be the answer in dollars.

EXAMPLES.

12. Given 734*l.* 3*s.* 6*d.* being the amount of an invoice of linen from Belfast, to be changed into federal money.

Ans. $3012.

13. What is the federal value of an Irish invoice amounting to 183*l.* 10*s.* 10½*d.* *Ans.* $753.

II. *To change federal money into Irish currency.*

RULE—Multiply the dollars by 39, and divide the product by 160, the quotient will be the answer in Irish currency.

EXAMPLES.

14. Given $3012, the amount of an invoice from Belfast: Now tell me what it was originally in that currency?

Ans. 734*l.* 3*s.* 6*d.*

15. Admit $753 to be the federal value of an invoice from Ireland, what was the original amount thereof in that currency? *Ans.* 183*l.* 10*s.* 10½*d.*

EXCHANGE WITH HOLLAND.

In Holland accounts are kept in guilders, stivers and pennings, or, in pounds, schillings and pence, Flemish, by which name their money is distinguished.

				s.	d.	
8 pennings, or 2 duytes	make	1 groat or penny,	=	0	0.54	par in ster.
2 groats or 16 pennings		1 stiver,	=	0	1.09	
20 stivers or 40 pence		1 guilder or florin	=	1	9.86	

Also,

12 groats or 6 stivers,	make	1 schilling,	=	0	6.56	par in ster.
20 schillings or 6 guilders		1 pound Flem.	=	10	11.18	

The United States exchanges with Holland at 40 cts. more or less per guilder banco.

There are two sorts of money, viz: bank and current.—The bank money is generally rated from 3 to 6 per cent. better than the current. The difference between bank and current money is called the agio.

I. *To change current money to bank money.*

RULE.—As 100 + agio : is to 100 : : So is the given sum in current money : to the answer in bank money.

EXAMPLES.

16. What will 3105 guilders, current money, amount to in bank money, the agio being $3\frac{1}{2}$ per cent? *Ans.* 3000.

17. What will be the amount in bank money, of $2279\frac{1}{16}$ guilders, current money, when the agio is $3\frac{1}{8}$ per cent? *Ans.* 2210.

II. *To change bank money to current money.*

RULE—As 100 : is to 100 + agio : : So is the given sum in bank money : to the answer in current money?

EXAMPLES.

18. What will be the amount in current money of 3000 guilders, bank money, the agio being $3\frac{1}{2}$ per cent? *Ans.* 3105.

19. What will 2210 guilders in bank money, amount to in current money, supposing the agio to be $3\frac{1}{8}$ per cent. *Ans.* 2279 *guil.* 1 *st.* 4 *pen.*

III. *To change Flemish, pounds, schillings and pence, into guilders.*

RULE—Reduce the given sum into pence Flemish, then divide by 40, and the quotient will be guilders.

EXAMPLES.

20. Exchange 242*l.* 13*s.* 6*d.* Flemish, into guilders, stivers, &c. *Ans.* 1456 *guil.* 1 *stiv.*

21. Change 845*l.* 17*s.* 9*d.* Flemish, into guilders, &c. *Ans.* 5075 *guild.* $6\frac{1}{2}$ *stiv.*

IV. *To change guilders into Flemish pounds, schillings, and pence.*

RULE—Reduce the given sum in guilders into half stivers, which will be pence Flemish, this sum divided by 12 and 20 will quote the pounds, schillings and pence?

EXAMPLES.

22. Let 1456 guilders, 1 stiver, be changed into Flemish pounds, schillings and pence? *Ans.* 242*l.* 13*s.* 6*d.*

23. What will 5075 guilders, $6\frac{1}{2}$ stivers amount to in pounds, schillings and pence, Flemish? *Ans.* 845*l.* 17*s.* 9*d.*

V. *To change guilders into federal money.*

RULE—Multiply the guilders by the rate of exchange: the product will be the answer in dollars.

EXAMPLES.

a merchant to sell a bill on Holland for 1624

guilders, 16 stivers, at 40 cents per guilder. I demand the amount in federal money. *Ans.* $650 32 *c.*

25. What shall I receive in federal money for 2461 guilders, if I negotiate my draft for the same at 39 cents per guilder? *Ans.* $959 79 *c.*

VI. *To change federal money into guilders.*

RULE—Divide the given sum in federal money by the rate of exchange: the quotient will be the answer in guilders.

EXAMPLES.

26. What will be the amount in guilders of that bill which I can buy on Holland for $650 32 cts. exchange at 40 cents per guilder. *Ans.* 1625 *guild.* 16 *stiv.*

27. How many guilders can I remit to Holland for $959 79 cts. when the exchange is at 39 cents per guilder? *Ans.* 2461 *guilders.*

EXCHANGE WITH HAMBURGH.

Books of accounts are kept in marks, schillings and deniers-lubs, or in pounds, schillings and pence, Flemish.

			s. d.	
12 denier-lubs	make	1 sous lub,	= 0 1½	par in exer.
16 sous lubs		1 mark, lub, or banco,	= 1 6	
2 marks		1 dollar,	= 3 0	
3 m. lubs		1 rix dollar,	= 4 6	
2½ rix dollars		1*l.* gross or Flemish,	= 11 3	

The United States exchanges with Hamburgh at 35⅓ cts. more or less per mark banco.

Hamburgh has two sorts of money as well as Holland, and on account of the convenience and security of the bank, the money thereof runs from 20 to 30 per cent. higher than the current, and is called the agio.

I. *To change current money to bank money.*

RULE—Being the same as for changing current guilders to bank guilders of Holland.

EXAMPLES.

28. What amount in banco, can be purchased for 7325 marks currency, when the agio is at 25 per cent? *Ans.* 5940.

29. Required the amount of 2450 marks current, in banco, when the agio is at 22½ per cent? *Ans.* 2000.

II. *To change bank money to current money.*

RULE—Being the same as for changing bank guilders to current guilders.

EXAMPLES.

30. If 5940 marks banco, should be changed into marks current, what will be the amount when the agio is at 25 per cent? *Ans.* 7325.

31. If A. of Philadelphia draw a bill of 2000 marks banco on B. of Hamburgh, what amount in current marks, will be sufficient to discharge said bill, admitting the agio to be at $22\frac{1}{2}$ per cent? *Ans.* 2450

III. *To change marks banco into federal money.*

RULE—Multiply the marks by the rate of exchange, and the product will be federal dollars.

EXAMPLES.

32. Suppose a bill of exchange on Hamburgh for 12483 marks 10 sous 8 deniers banco, to be sold at 32 cents per mark: what would be the amount in dollars? *Ans.* 3994.77\frac{1}{8}$.

33. If a merchant in Albany draw on Hamburgh for 13862*m.* 13*s.* 9*d.* and negotiate his bill in New-York at par; what does he receive in dollars? *Ans.* 4620.953\frac{1}{4}$

IV. *To change federal money to marks banco.*

RULE—Divide the given amount in federal money by the rate of exchange and the quotient will be the answer in marks.

EXAMPLES.

34. How many marks banco of Hamburgh can I purchase for $5461.75 when the exchange is at 32 cents per mark? *Ans.* 17067 *m.* 15*s.* 6*d.*

35. Having funds in Hamburgh, and a note to take up at the bank, for 4871\frac{1}{2}$. How many marks banco must I draw for in order to raise that sum, when the exchange is at par? *Ans.* 14614 *m.* 8*s.*

EXCHANGE WITH BREMEN.

In this city and its dependencies books and accounts are kept in dollars (thalers) and groats (groten.)

			s.	d.	
5 schwaren - - -	make	1 groat or groten	0	0$\frac{5}{7}$	for instance.
12 groats or gröten		1 kopfstucke - -	0	6$\frac{2}{7}$	
6 kopfstuckes - -		1 dollar or thaler	3	4	

The United States exchanges with Bremen at 75 cents, more or less per thaler in louis d'or. The silver money which is current here has been very much adulterated of late, so that it is now an established custom among the merchants to make large accounts and bills of exchange payable in louis d'or.

I. *To change Bremen dollars or thalers into federal money.*

the thalers by the rate of exchange, and the answer in federal money.

EXAMPLES.

36. What must be paid in federal money for a bill of exchange on Bremen for 8132 rix thalers in louis d'or, when the exchange is at par. *Ans.* $6099.

37. How much federal money will I receive for my draft on Bremen for 7815 thalers 48 groten in louis d'or, when the exchange is at 75½ cents per thaler; *Ans.* $5900.8283.

II. *To change federal money to thalers of Bremen.*

RULE—Divide the amount given in federal money by the rate of exchange, and the quotient will be the answer in thalers.

EXAMPLES.

38. How many thalers of Bremen can I purchase for $6099 federal money, supposing the exchange to be at par? *Ans.* 8132 *thalers.*

39. Having shipped 57 hhds. tobacco per the Patuxent, O. C. master, consigned to F. B. of Bremen, who allows ⅔ of the value of the invoice to be drawn for on receiving it with the bill of lading and orders to have insurance effected thereon, which amounts to $5527.375 federal money, these requisites complied with; quere the amount of my anticipation draft, in thalers of Bremen, when the exchange is at 74 cents per thaler? *Ans.* 4979 *th.* 44 *gr.*

EXCHANGE WITH FRANCE.

In this country accounts are kept in livres, sols and deniers, tournois a word applied to this money as sterling is to that of England.

				s.	d.	
12 deniers	make	1 sol - -	=	0	$0\frac{39}{80}$	pd. in ster.
20 sols		1 livre -	=	0	$9\frac{4}{5}$	
3 livres.		1 crown	=	2	$5\frac{1}{5}$	

The United States exchanges with France at 18½ cents more or less per livre tournois.

I. *To change livres tournois to federal money.*

RULE—Multiply the livres tournois by the rate of exchange, and the product will be the answer in federal money.

EXAMPLES.

40. Suppose I sell my draft on Paris for 5000 livres tournois, how much federal money will I receive when the exchange is at 17 cents per livre? *Ans.* $850.

41. What shall I receive in federal money for 2305 livres tournois, if I negotiate my draft on Bourdeaux for the same at 17¼ cents per livre? *Ans.* $397 61¼c.

II. *To change federal money to livres tournois.*

RULE—Divide the federal money, by the rate of exchange, the quotient will be the answer in livres tournois.

EXAMPLES.

42. Required the amount in livres tournois of that bill which I can buy on Paris for $850, exchange at 17 cents per livre?
Ans. 5000 *livres.*

43. How many livres can be remitted to France for $397 61½ cents when the exchange is at 17¼ cents per livre tournois?
Ans. 2305 *livres.*

The present money of account in France is in francs and centimes, or hundredth parts, and is in proportion to the livre tournois as 80 is to 81.

III. *To change livres tournois to francs.*

RULE—Multiply the livres by 80, and divide the product by 81, the quotient will be the answer in francs.

EXAMPLES.

44. Change 58644 livres tournois to francs.
Ans. 57920 *francs.*

45. Change 405 livres tournois to francs. *Ans.* 400 *francs.*

IV. *To change francs to livres tournois.*

RULE—Multiply the francs by 81 and divide the product by 80, the quotient will be the answer in livres tournois.

EXAMPLES.

46. Change 57920 francs to livres tournois? *Ans.* 58644 *liv.*

47. Change 400 francs to livres tournois? *Ans* 405 *livres.*

EXCHANGE WITH SPAIN.

The monies of Spain are of two sorts, viz. vellon and old plate; the latter is more valuable than the former in the proportion of 32 to 17.

Accounts are kept in piastres, peso, called also dollars, rials and maravedies, shopkeepers reckon by vellon, and foreign traders by plate-money, in which bills of exchange are always paid.

2 maravedies vellon	make	1 quartile.
4 do. do.		1 quarto.
8½ quart. or 34 mar.		1 rial vellon.
15 rials vellon - - - -		1 peso or current dollar.
20 do. - - - - - - - - - -		1 hard dollar.

Also,

		Par in Sterling.	s. d.
64 maravedies vn. or, 4 maravedies plate	make	1 rial plate - - - - - -	=0 5¾
[illegible] - - - - - - -		1 piastre of exchange	=3 7
- - - - - -		1 dollar - - - - - - - - -	=4 5¾
die plate		1 ducat of exchange	=4 8 23/273
change		1 pistole of exchange	14 4

The United States exchanges with Spain at 80 cents more or less per piastre of exchange.

I *To change rials vellon to rials of exchange or plate.*

RULE—Multiply the rials vellon by 17 and divide the product by 32, the quotient will be the rials plate.

EXAMPLES.

48. Change 1200 rials vellon to rials of exchange or plate. *Ans.* 637½ *rials plate.*

49. Change 2282 rials 12 mar. vellon, to rials plate? *Ans.* 1212½ *rials plate.*

II. *To change rials of exchange or plate to rials vellon.*

RULE—Multiply the rials plate by 32 and divide the product by 17, the quotient will be the rials vellon.

EXAMPLES.

50. Change 637½ rials plate to rials vellon. Ans. 1200 *ri. vn.*

51. Change 1212½ rials plate to rials vellon. Ans. 2282 *ri.* 12 *mar.*

III. *To change rials plate to federal money.*

RULE—Multiply the rials plate by 32, and divide the product by 17 for rials vellon, and by 20 for dollars.

EXAMPLES.

52. Change 960 rials plate, to dollars of the United States. Ans. $90.35294.

53. Change 875 piastres, 6 rials, 25½ maravedies, to dollars. Ans. $700.675.

IV. *To change federal money to rials plate.*

RULE—Multiply the dollars by 20 for rials vellon, which again multiply by 17, and divide by 32, will give the rials plate, or multiply the dollars by 10⅝ for rials plate.

EXAMPLES.

54. Change $625 to rials plate? Ans. 6640 *rials,* 21¼ *mar. pl.*

55. Change $96 to rials plate? Ans. 1020 *rials plate.*

V. *To change piasters of exchange to federal money.*

RULE—Multiply the piastres by the rate of exchange, and the product will be the answer in federal money.

EXAMPLES.

56. What will my bill amount to in dollars, if I draw on Cadiz for 875 piastres, exchange at 78 cents per piastre? Ans. $682 50 *cts.*

57. What would have been the amount in dollars for the above bill, had the exchange been at 82 cents per piastre? Ans. $717 50 ct

VI. *To change federal money to piastres of exchange.*

RULE—Divide the federal money by the rate of exchange, the quotient will be the answer in piastres.

EXAMPLES.

58. How many piastres can I remit to Spain for $6403 75 cents, exchange at par? Ans. 8004 *p.* 5*r.* 17 *mar.*

59. Sold my bill on Madrid for $666.068. Quere the amount in piastres, exchange at 84 cents?

Ans. 800 *p.* 4 *r.* 17 *mar.*

EXCHANGE WITH PORTUGAL.

The Portuguese keep their accounts in milrees and rees.

		Par in sterling.	*£. s. d. q.*
400 rees unstamped	make	1 ree, - - - - - - - - =	0 0 0.27
480 rees stamped		1 crusado of exchange,	2 3 0
1000 rees ———		1 new crusado, - - =	2 8 1.6
4800 rees ———		1 milree, - - - - - =	5 7 2
12800 rees ———		1 moidore, - - - - - - =	1 7 0 0
		1 Johannes, - - - - =	3 12 0 0

The United States exchanges with Portugal at 125 cents more or less per milree.

I. *To change milrees to federal money.*

RULE—Multiply the milrees by the rate of exchange, and the product will be the answer in federal money.

EXAMPLES.

60. Having received accounts from Lisbon that the sales of my wheat has neated 1933 milrees, 700 rees; how much will it amount to in federal money if I value for the same when the exchange is at par. *Ans.* $2417.125.

61. What would have been the difference in federal money on the above sum had the bill been negotiated at 2 per cent under or 3 per cent above par? Ans. $120.85625.

II. *To change federal money to milrees.*

RULE—Divide the federal money by the rate of exchange, and the quotient will be the answer in milrees.

EXAMPLES.

62. Having drawn on Lisbon for $2417 12½ cents, how many milrees will pay my bill when the exchange is at par.

Ans. 1933 *mil.* 700 *rees.*

63. How many milrees of Portugal will $1000 amount to, hange is at 122½ cents per milree.

Ans. 816 *mil.* 326$\frac{26}{45}$ *rees.*

EXCHANGE WITH GENOA.

In this city and its dependencies accounts are kept in denari, soldi, and lire or pezza.

Lire money.			*Exch. money.*		*Par in ster.*	*s.*	*d.*
12 denari	make	1 soldo,	12 denari,	make	1 soldo	=0	$2\frac{9}{20}$
20 soldi		1 lira,	20 soldi,		1 pezza	=4	1

The pezza of exchange is equal to $5\frac{3}{4}$ lire, consequently exchange money is $5\frac{3}{4}$ times better than lire money.

I. *To reduce lire money to that of exchange.*

RULE—Multiply the lire money by 4 and divide the product by 23.

EXAMPLE.

64. In 4416 lire, how many pezze of exchange?
Ans. 768 *pezze.*

II. *To reduce money of exchange to lire.*

RULE—Multiply the exchange money by $5\frac{3}{4}$, the product is lire.

EXAMPLE.

65. In 768 pezze of exchange, how many lire?
Ans. 4416 *lire.*

EXCHANGE WITH LEGHORN.

In this city, most of the retailers keep their accounts in lire, soldi, and denari of the lira, but bankers and foreign merchants, in pezze of eight rials, soldi, and denari of the pezza.

			Ex. money.		*Par in ster.*	*s.*	*d.*
12 denari di lira	make	1 soldo,	12 den. di pez.	make	1 soldo,	0	$2\frac{1}{2}$
20 soldo di lira		1 lira,	20 soldi di pez.		1 pezza,	4	2

Long money is 6 lire to the pezza, in which all sales are made, exchange or good money $5\frac{3}{4}$ lire is a pezza in which all large sums and bills of exchange are paid.

RULE—The same as for the lire and exchange money of Genoa.

EXCHANGE WITH NAPLES.

In this part of Italy accounts are kept in ducats and grains, or as follows:

			s.	*d.*	
20 grani	make	1 taro,	=0	$8\frac{1}{10}$	*sterling.*
5 tari		1 ducat	=3	$4\frac{1}{2}$	

EXCHANGE WITH VENICE.

In this famous city, they reckon by ducats of 24 grossi, and the grosso of $5\frac{1}{2}$ soldi, yet bankers and negotiators for

the facility of computation, usually divide it as follows, and keep their accounts accordingly.

			s. d.	
12 denari 20 soldi	make	1 soldo,	=0 $2\frac{11}{20}$	sterling.
		1 ducat,	=4 3	

The money of Venice is of three sorts, viz: Banco money, banco current money, and picoli money. The banco money is 20 per cent better than the banco current, and the banco current 20 per cent better than the picoli money.

Par of exchange at different places.

The above are the chief places in Europe, with which Britain exchanges, hence bills drawn in the United States on any other place are generally made payable in London, Amsterdam, Hamburgh, &c. However the par of exchange betwixt Britain and most other places, with which we have any commercial intercourse, is here subjoined.

			£. s. d.
Rome,	1 stamped crown, - - - -	=	6 $1\frac{2}{5}$
Sicily,	1 onze, - - - - - - - - - -	=	11 3
Trieste	1 florin, - - - - - - - - -	=	2 4
Vienna,	1 rix dollar, - - - - - - -	=	4 8
Milan,	1 scudo, - - - - - - - - -	=	3 $8\frac{1}{5}$
Nice,	1 lire, - - - - - - - - - -	=	1 0
Frankfort,	1 florin, - - - - - - - - -	=	3 0
Berlin,	1 rix dollar, - - - - - - -	=	4 0
Dantzick,	1 florin, - - - - - - - - -	=	0 9.137
Lubeck,	1 mark, - - - - - - - - -	=	1 6
Copenhagen,	1 rix dollar, - - - - - - -	=	4 0
Stockholm,	1 rix dollar, - - - - - - -	=	4 $7\frac{2}{5}$
Petersburgh,	1 rouble, - - - - - - - - -	=	4 1
Turkey,	1 piastre of 100 aspers, -	=	2 $5\frac{3}{5}$
Aleppo,	1 piastre of 80 aspers, - -	=	2 3

EXCHANGE WITH ENGLISH WEST-INDIES.

Books and accounts are kept in pounds, shillings and pence, and the currencies are from 6*s*. to 6*s*. 8*d* the dollar.

EXCHANGE WITH FRENCH WEST-INDIES.

Books and accounts are kept in livres, sols and deniers, and the currencies are from 8 livres, 5 sols, to 9 liv. the dollar.

EXCHANGE WITH DUTCH WEST-INDIES, &c.

Books and accounts are kept in florins, stivers, &c. and the currencies are to money of Holland, as 6 is to 5.

EXCHANGE WITH SPANISH WEST-INDIES, &c.

kept in every part of Spanish America in maravedies de plata Mexicanos.

34 maravedies	make	1 rial,	=$0 125 fed. money.
8 rials		1 peso,	= 1 00

EXCHANGE WITH BRASIL.

In this part of South-America, appertaining to Portugal, accounts are kept as in the mother-country, in milrees and rees, but the *pataque* money which is current here at 320 rees, is worth no more than 240 in Portugal.

EXCHANGE WITH BOMBAY.

Since the English became masters of this Island, there have been fabricated coins of silver, copper and tin. Accounts are kept in rupees, quarters and rees.

25 rees, or 6 rupees of copper	make	1 quarter,	$0.11625
100 rees, or 24 rupees of copper		1 rupee of silver,	0.465
12½ rupees of silver,		1 moharre.	5.8125

EXCHANGE WITH CALCUTTA.

In this part of the Malabar coast, accounts are kept in rupees, fanos and bises.

12 bises	make	1 fano,	=$0.02948125
16 fanos		1 rupee,	= 0.4717

EXCHANGE WITH MADRAS.

Accounts are kept at this English establishment on the coast of Coromandel, in pagodas, fanams, and cas.

80 cas	make	1 fanam,	=$0.048
36 fanams		1 pagoda,	= 1.728

EXCHANGE WITH BATAVIA.

In this, the capital of the Dutch East-India Company, accounts are kept in piastres, and stivers.

60 stivers make 1 piastre, = $1.00.

EXCHANGE WITH CHINA.

In this Empire they reckon by tales, maces, candareens and caxa.

10 caxa	make	1 candareen,	=$0.0148
10 candareens		1 mace,	= 0 148
10 maces		1 tale,	= 1.48

EXCHANGE WITH JAPAN.

In this Empire, accounts are kept for the most part in tales, maces and candareens,

10 candareens,	make	1 mace,	=$0.14
10 maces,		1 tale,	= 1.40

ARBITRATION OF EXCHANGES.

To merchants who have foreign concerns it is of the greatest importance to be acquainted with the mode of arbitrating the exchanges between places, which is either simple or compound.

SIMPLE ARBITRATION.

A simple or single arbitration is to be solved by direct or inverse proportion as in the following

RULE—When the first term of stating is more than the third, and the quotient required to be less than the middle term, or, when the first term is less than the third, and quotient required to be more than the third, then is the rule direct. But when the first term is less than the third, and the quotient required to be less than the middle term, or, when the first term is more than the third, and the quotient required to be more than the middle term, then is it inverse.

EXAMPLES.

1. If exchange from New-York to Amsterdam be 40 cents per guilder banco; and if exchange from New-York to London be $445 per 100*l* sterling: What must be the rate of exchange from Amsterdam to London, in order to be on a par with the other two? *Ans.* 37*s.* 1*d. flemish.*

2. If exchange from London to Amsterdam be 33*s.* 9*d.* per £ sterling; and if exchange from London to Paris be 32*d.* per crown: What must be the rate of exchange from Amsterdam to Paris, in order to be on a par with the other two? *Ans.* 54*d. flem. per crown.*

3. A. of Oporto had orders to draw on Rouen, at 490 rees per crown of 60 sols, provided he could at the same time remit on Leghorn at 770 rees per pezza; but as on receipt of the said order he could get no more for his bill than 488 rees: It is demanded at what price he ought to remit on Leghorn, to recompence the said diminution in his draft.

Ans. $766\frac{6}{7}$ *rees.*

4. B. of Amsterdam gives an order to E. at Cadiz, to remit on Hamburgh at 124 gros-lubs for 1 ducat of 375 maravedies, and to draw for him at 126 groats de gros for the said ducat. It is required at what price the exchange will be between Amsterdam and Hamburgh?

Ans. $32\frac{16}{31}$ *stiv. per dollar of* 32*s. lubs.*

5. If exchange from London to Paris be 32*d.* sterling per crown of 3 livres tournois, and to Amsterdam 405*d.* flemish per £. sterling; and if by advice from Holland or France, the course of exchange between Paris and Amsterdam is fal-

len to 52*d*. flemish, per crown: What may be gained per cent. by drawing on Paris and remitting to Amsterdam.

Ans. 3*l*. 14*s*. $0\frac{3}{5}$*d*. *gained per cent.*

COMPOUND ARBITRATION.

In compound arbitration the rate or price of exchange between three, four, or more places, is given, in order to find how much a remittance passing through them all will amount to at the last place: or to find the arbitrated price, or par of arbitration, between the first place and the last.

RULES 1st. Distinguish the given rates or prices into antecedents and consequents: place the antecedents in one column, and the consequents in another on the right, fronting one another by way of equation.

2d. The first antecedent, and the last consequent to which an antecedent is required, must always be of the same kind.

3rd. The second antecedent must be of the same kind with the first consequent, and the third antecedent of the same kind with the second consequent, &c.

4th. If to any of the numbers a fraction be annexed, both the antecedent and its consequent must be multiplied into the denominator.

5th. To facilitate the operation, terms that happen to be equal or the same in both columns, may be dropped or rejected, and the other terms may be abridged.

6th. Multiply the antecedents continually for a divisor, and the consequents continually for a dividend, and the quotient will be the answer, or antecedent required.

EXAMPLES.

6. Suppose a merchant in any part of the United States would remit $2000 to London the direct exchange being $445 for 100*l*. sterling. It is required whether will be more profitable the direct remittance, or by remitting first to Holland at 40 cents per gilder banco: thence to France, at 58*d*. flem. per crown, thence to Venice, at 100 crowns, for 63 ducats, and thence to London at 50*d*. ster. per ducat.

Antecedents.		*Consequents.*	*Abridged.*
40 cents	=	1 guilder or 40*d*. Flem.	1 = 1
58*d*. Flem	=	1 crown,	29 = 1
100 crowns	=	63 ducats,	1 = 21
1 ducat	=	50*d*. sterling.	1 = 1
How many £. ster.	=	$2000	1 = $2

Then 29 divisor; and $21 \times 625 = 13125$ dividend: Hence,

29)13125(452*l.* 11*s.* 8*d.* $2\frac{22}{29}$ *qrs.* = \$2000 by circular exchange.

But \$445 : 100*l.* ster. : : 2000 : 449*l.* 8*s.* 9*d.* $0\frac{60}{89}$ *qrs.* = \$2000 by direct exchange.

7. Holland owes the United States 4000 guilders: whether is it more advantageous to draw at 38 cents per guilder, or to have the money remitted first to Paris, at 54*d.* flem. per crown; thence to Genoa at 5 liv. tour. per piastre; thence to London at 50*d.* sterling per piastre, and then drawn for from the United States at par?

Ans. \$126.09$\frac{12}{243}$ *gain by remitting.*

8. If London remit 1000*l.* ster. to Spain by way of Holland at 35*s.* Flem. per £ ster. thence to France at 58*d.* Flem. per crown; thence to Venice, at 100 crowns per 60 ducats: and thence to Spain, 360 maravadies per ducat: how many piastres of 272 maravadies, will the 1000*l.* ster. amount to in Spain.

Antecedents.		*Consequents.*	*Abridged.*
1 £ Sterling,	=	35*s.* or 420*d.* Flem.	1 = 210
58*d.* Flemish,	=	1 Crown France.	29 = 1
100 Crowns France,	=	60 ducats Venice.	1 = 30
1 ducat Venice,	=	360 maravedies Spain.	1 = 45
272 maravadies,	=	1 piastre.	17 = 1
How many piastres,	=	1000 £. Sterling.	= 10

$$\frac{210 \times 30 \times 45 \times 10}{29 \times 17} = 5750\tfrac{1}{2} \text{ piastres. Ans.}$$

9. A banker in Amsterdam remits to London 400*l.* Flemish; first to France at 56*d.* Flem. per crown, from France to Venice, at 100 crowns per 60 ducats; from Venice to Hamburgh at 100*d.* Flem. per ducat; from Hamburgh to Lisbon, at 50*d.* Flem. per crusade of 400 rees; and, lastly from Lisbon to London, at 64*d.* ster. per milree: How much ster. money will the remittance amount to? and how much will be gained, supposing the direct exchange from Holland to London at 36*s.* 10*d.* Flemish per £. sterling?

Ans. 2*l.* 4*s.* $8\frac{1}{4}$*d. gained.*

10. A merchant at London has credit for 680 piastres at Leghorn, for which he can draw directly at 50*d.* ster. per piastre but chusing to try the circular way, they are by his order remitted, first to Venice, at 94 piastres per 100 ducats banco; thence to Cadiz, at 320 maravedies per ducat; thence to Lisbon at 630 rees per piastre of 272 Maravedies; thence to Amsterdam, at 50*d.* Flem. per crusade of 400 rees; thence to Paris, at 56*d.* Flemish per crown; thence to London, at $31\frac{1}{2}$*d.* sterling per crown. What is the arbitrated price be-

tween London and Leghorn per piastre; and how much is the circular remittance better than the direct draft, without reckoning changes.

Ans. 14*l.* 11*s.* 8*d. gained.*

Note—Not only may different sorts of money be equated in the manner above described, but also weights and measures.

EXAMPLES.

11. If 102 lb. of Hamburgh be equal to 100 lb. at Amsterdam, and 100 lb. of Amsterdam to 98 lb. at Frankfort, and 98 lb. at Frankfort to 105 lb. at Leipsic, and 105 lb. of Leipsic to 145 lb. at Leghorn, and 145 lb. at Leghorn to 106 lb. at Cadiz, and 100 lb. at Cadiz to 103$\frac{1}{3}$ lb. at London: how many lb. at London are equal to 3060 lb. at Hamburgh.

Ans. 3286 *lb. at London*

12. If 1$\frac{1}{2}$ ells, or aunes of Hamburgh, make 1 ell in Holland, and 7 in Holland make 4 in France, and 7 in France make 5 yards in England; how many yards in England are equal to 588 ells, or aunes of Hamburgh? and what their price, at the rate of 4*l.* sterling for 5 yards English.

Ans. 200 *yards, and* 160*l. sterling.*

FELLOWSHIP.

Fellowship, called also Partnership, is when two or more persons put together a general stock in trade, or are concerned in ships, &c.

By this rule are adjusted the gains, losses or charges of partners in company; the effects of bankrupts; legacies in case of a deficiency of effects; shares of prizes, &c. &c.

Fellowship is either without or with time, called single or compound.

SINGLE FELLOWSHIP.

RULE—Add the several stocks into one sum. Then as the general stock: is to the general gain or loss: : so is each man's particular stock: to his particular share of the gain or loss.

EXAMPLES.

1. Two men, A. and B. are partners in trade: A. put in 250*l.* and B. 750*l.* by trading they gain 155*l.* 12*s.* 6*d.* Required each man's share of the gain?

general stock.	*general gain.*		*l.*	*s.*	*d.*	
250+750 :	155 12 6 : :	250 :	38	18	1$\frac{1}{2}$	*A's gain.*
		750 :	116	14	4$\frac{1}{2}$	*B's gain.*
			£155	12	6	*Proof.*

2. Divide 240 into three such parts as shall be in proportion to each other as the three numbers 1, 2 and 3?

Ans. 40, 80, 120.

3. Three persons have gained $1320; now when A. takes $6, B. takes $4, and C. $2. I demand how much each gets?

Ans. A. $660, B. $440, C. $220.

4. A. B. and C. make a joint stock: A. puts in 460*l.* B. 510*l.* and C. 480*l.*; they gain 340*l.* What is each partners gain?

		l.	*s.*	*d.*	*qrs.*
Ans. gain of	*A.* =	107	17	2	$3\frac{85}{115}$.
	B. =	119	11	8	$2\frac{110}{145}$.
	C. =	112	11	0	$1\frac{95}{145}$.

5. Four merchants, A. B. C. and D. built a sloop which cost $1730; and the freight for her first voyage amounted to $370, of which A's share was $74, B's $111, C's $148, and D's $37. What was each partners stock?

Ans. A's stock was $346, *B's* $519, *C's* $692, *D's* $173.

6. Three persons A. B. & C. freighted a ship with 340 tuns of wine; of which A. loaded 110 tuns, B. 97, and C. the rest: in a storm the seamen were obliged to throw overboard 85 tuns. How much must each sustain of the loss?

Ans. A's loss was $27\frac{1}{2}$ *tuns, B's* $24\frac{1}{4}$, *C's* $33\frac{1}{4}$.

7. A general imposing a contribution of $70000 on four towns, to be paid in proportion to the number of inhabitants contained in each; the 1st. containing 2500, the 2d. 3500, the 3d. 4000, and the 4th. 5000 persons. What part must each town pay?

Ans. The 1*st. to pay* 11666\frac{2}{3}$, *the* 2*d.* 16333\frac{1}{3}$, *the* 3*d.* 18666\frac{2}{3}$, *the* 4*th.* 23333\frac{1}{3}$.

8. A detachment, consisting of 5 companies, being sent into a garrison, in which the duty required 76 men a day: What number of men must be furnished by each company in proportion to their strength; the 1st. consisting of 54 men, the 2d. of 51 men, the 3d. of 48 men, the 4th of 39, and the 5th. of 36 men?

Ans. The 1*st. must furnish* 18, *the* 2*d.* 17, *the* 3*d.* 16, *the* 4*th* 13, *and the* 5*th.* 12 *men.*

9. A. B. C. and D. in partnership had a joint stock of $6000, and gained a certain sum; of which A. B. and C. took up $600; B. C. and D. $900; A. C. and D. $800; and A. B. and D. $700. What was the stock and gain of each partner?

Answer,	*A's stock*	$ 600,	*and his gain*	$100.
	B's ——	$1200,	————	$200.
	C's ——	$1800,	————	$300.
	D's ——	$2400,	————	$400.

B. and C. join in an adventure to Upper they jointly purchase goods to the value mplete the assortment, the partners from it in such articles as they had proper, viz.

A. to the value of 100*l.* B. 200*l.* and C. 300*l.*; the neat proceeds of their returns in furs and peltries, amounted to 6930*l.* What share of this belongs to each partner?

Ans. *To A.* 2117*l.* 10*s.* *to B.* 2310*l.* *to C.* 2502*l.* 10*s.*

COMPOUND FELLOWSHIP.

Compound Fellowship as has been said, is concerned in cases in which the stocks of partners are employed for different times.

RULE—Multiply each person's stock by the time it has continued in trade, and proceed with the products, as with the particular stocks in Single Fellowship.

EXAMPLES.

1. A. and B. are partners; A. put in 60*l.* for 3 months, and B. 50*l.* for 4 months; at the end of which they find a gain of 30*l.* Required each man's share thereof?

$60\times3=180$
$50\times4=200$

$$380 : 30 :: \begin{cases} 180 : 14\ \ 4\ \ 2\ \ 2\frac{40}{380} \textit{ A's gain.} \\ 200 : 15\ \ 15\ \ 9\ \ 1\frac{340}{380} \textit{ B's gain.} \end{cases}$$

2. Three merchants, A. B. and C. enter into partnership, thus; A. puts into the stock 240*l.* for 4 months, B. 120*l.* for 6 months, and C. 200*l.* for 8 months; with this joint stock they traffic and gain 260*l.* it is required to find each person's gain?

$$\textit{Ans.} \begin{cases} 76\ \ 1\ \ 11\ \ 1\frac{216}{328}\ \textit{A's} \\ 57\ \ 1\ \ 5\ \ 2\frac{80}{328}\ \textit{B's} \\ 126\ \ 16\ \ 7\ \ 0\frac{32}{328}\ \textit{C's} \end{cases} \textit{gain.}$$

3. Three butchers A. B. and C. hire a pasture for $24: A. puts in 40 sheep for 4 months, B. 30 sheep for 2 months, and C. 36 sheep for 5 months: what share of the rent must each pay? *Ans. A's share* $9 60*c.* *B's share* $3 60*c.* *C's share* $10 80*c.*

4. A ships company take a prize, value 4000*l.* sterling, which they agree to divide amongst them, according to their pay and time they have been on board: now the officers and midshipmen have been on board 4 months, and the sailors 3; the officers have 50*s.* a month, the midshipmen 40*s.* and the sailors 27*s.* moreover there are 4 officers, 8 midshipmen, and 120 sailors: I demand to know what each person's share is of the said prize?

$$\textit{Answer} \begin{cases} 65\ \ 15\ \ 9\ \ 1\frac{10880}{12160}\ \textit{each officer's} \\ 52\ \ 12\ \ 7\ \ 2\frac{3840}{12160}\ \textit{each midship.} \\ 27\ \ 12\ \ 7\ \ 2\frac{3840}{12160}\ \textit{each sailor's} \end{cases} \textit{share.}$$

5. Three merchants A. B. and C. in partnership together for a year, put into one common stock as follows, viz. A. put in 400*l.* and at the end of 6 months withdraws 200*l.* B. puts in 360*l.* and at the end of 7 months 100*l.* more, but at the end of 9 months he takes out 120*l.* C. puts in 190*l.* and at the end of 8 months 110*l.* more, but at the end of 10 months he takes out 100*l.* they gain 460*l.* what is each man's share?

	l.	*s.*	*d.*	*qrs.*	
Answer	156	10	5	$0\frac{920}{1058}$	A's
	193	18	3	$0\frac{552}{1058}$	B's
	109	11	3	$2\frac{644}{1058}$	C's

share.

ALLIGATION.

Alligation serves to solve questions that relate to the mixing of simples, and is either medial or alternate.

ALLIGATION MEDIAL.

Alligation Medial, from the rates and quantities of the simples given, discovers the rate of the mixture.

RULE.—Multiply each quantity by its rate: then say as the sum of the quantities : is to the sum of the products : : so is any part of the mixture : to the rate or value of that part.

EXAMPLES.

1. A grocer mingleth several sorts of sugar as follows, viz: 75 lb. at 10 cts. per lb.; 80 lb. at 11 cts.; 90 lb. at 13 cts. and 55 lb. at 14 cts. What is a pound of this mixture worth?

lb.	*cts.*	*cts.*
75	× 10 =	750
80	× 11 =	880
90	× 13 =	1170
55	× 14 =	770

As 300 : 3570 : : 1 : $11\frac{7}{30}$ *lb.* *cts.* *Answer.*

2. A vintner mingled 15 gallons of Canary, at 8*s.* per gallon, with 20 gallons of Malaga, at 7*s.* 6*d.* per gallon, with 10 gallons of Lisbon, at 6*s.* 4*d.* and 24 gallons of French white wine at 4*s.* I demand the price of this mixture per gallon?

Ans. 6*s.* 2*d.* $2\frac{46}{69}$ *qrs.*

3. A refiner having 5 lb. of silver bullion, of 8 oz. fine, 10 lb. of 7 oz. fine, and 15 oz. of 6 oz. fine, which he melts together, required the fineness of 1 lb. of this silver?

Ans. 6 *oz.* 13 *dwts.* 8 *gr.*

Medicines are sometimes mixed or compounded by this [illegible] the manner whereof it will be necessary [illegible] medicines, drugs, or simples, with

respect to their qualities, are divided into five sorts, viz. hot, cold, dry, moist, temperate; and all, except the last, admit of four degrees, represented by indices, as in the following table:

Indices.	1	2	3	4	5	6	7	8	9
Degrees	4	3	2	1	0	1	2	3	4
	cold & moisture.				tem.	heat & dryness.			

The index 3 denotes cold or most in the 2d. degree, 9 denotes hot or dry in the 4th degree, and 5 denotes temperate.

4. Admit four simples, A. B. C. D. to be mixed as follows, viz: 4 oz. of A. hot in the 4th degree; 1 oz. of B. hot in the 2d.; 1 oz. of C. temperate, and 3 oz. of D. cold in the 3d. degree. What is the quality of the mixture or compound?

A. $4 \times 9 = 36$
B. $1 \times 7 = 7$
C. $1 \times 5 = 5$
D. $3 \times 2 = 6$

As 9 : 54 : : 1 : 6 hot in the 1st degree. *Answer.*

5. Suppose four simples, E. F. G. H. to be mixed as follows, viz: 3 oz. of E. dry in the 4th degree; 2 oz. F. dry in the 1st.: 4 oz. of G. moist in the 3d, and 1 oz. of H. moist in the 2d degree. Quere the quality of the mixture?

Answer, temperate.

ALLIGATION ALTERNATE.

Alligation alternate, being the converse of alligation medial from the rates of the simples, and rate of the mixture given, finds the quantities of the simples.

Rule 1.—Place the rate of the mixture on the left side of a brace, as the root; and on the right of the brace set the rates of the several simples under one another, as the branches.

2. Link or alligate together the branches, so that every one less than the root, be linked with some one greater, or with all that are greater, and every one greater than the root, be linked with one less, or with all that are less.

3. Set the difference betwixt the root and the several branches, right against their respective yoke-fellows.—These alternate differences are the quantities required, which quantities are the answer for that rate, against which they stand.

EXAMPLES.

6. To mix gold of 18 carats fine, with that of 23 carats

fine, of 19, and of 16 carets fine, so that the composition may be 20 carats fine. What quantity of each must be taken?

Ans. 3 *each of* 16, 18, 19, *and* 7 *of* 23.

7. A merchant would mix wines at 17*s*. 18*s*. and 22*s*. per gallon, so that the mixture may be worth 20*s*. per gallon What quantity of each must be taken?

Ans. 2 *at* 17*s*. 2 *at* 18*s*. *and* 5 *at* 22*s*.

8. I desire to know how much gun-powder at 36 cts. 27 cts. and 24 cts. per lb. will compose a mixture worth 30 cents per lb. *Ans.* 9 *lb. at* 36 *c. and* 6 *lb. each at* 27 *c. and* 24 *cts.*

9. It is required to mix tea at 7*s*. per lb. with some at 8*s*. 6*d*. and 5*s*. 10*d*. per lb. so that the mixture may be at the rate of 6*s*. 10½*d*. per lb?

Ans. 12½ *lb. each at* 7*s*. *and* 8*s*. 6*d*. *and* 21 *lb. at* 5*s*. 10*d*.

10. How much brandy at 14*s*. per gallon, and water must be mixed together, so that it may be worth 10*s*. per gallon?

Ans. 10 *gallons brandy, and* 4 *of water.*

11. An apothecary would mix four simples, viz. A. hot in the 4th degree; B. hot in the 2d; C. temperate, and D. cold in the 3d, so as the mixture may be hot in the first degree. What quantity of each simple must he take?

9	1 of A	1×9= 9	The branches may be alligated
6 7	4 of B	4×7=28	other 6 ways, which would give
5	3 of C	3×5=15	the like number of other answers.
2	1 of D	1×2= 2	
		6×9=54 proof. 54	

12. Admit an apothecary to mix four simples, viz: E. dry in the 4th degree; F. dry in the 1st; G. moist in the 3d, and H. moist in the 2d. Required the quantity of each simple so as to make the mixture temperate?

Ans. 3 *oz of E. dry in the* 4*th.* 2 *oz. of F. dry in the* 1*st.* 4 *oz. of G. moist in* 3*d. and* 1 *oz. of H. moist in the* 2*d. degree.*

ALLIGATION PARTIAL.

Alligation partial is when the price of each simple is given, also the quantity of one or more of them, and the mean rate, to find the several quantities of the rest.

RULE—Link or alligate the branches, and take the difference between each of them and the root, as in the last rule: then say, As the difference standing against the price of which the quantity is given, is to the said given quantity, so is any other difference, to the quantity required.

EXAMPLES.

13. How much tea at 6*s*. 6*d*. 7*s*. 6*d*. and 9*s*. per lb. must be

taken to be mixed with 36 lb. at 12*s*. per lb. that the mixture may be worth 8*s*. per lb ?

Ans. 108 *lb. at* 9*s*. 288 *lb. at* 7*s*. 6*d. and* 72 *lb. at* 6*s*. 6*d.*

14. How much alloy, and how much gold of 21 and 23 carats fine, must be melted with 30 oz. of 20 carats fine ?

Ans. $16\frac{2}{3}$ *oz. alloy,* 30 *oz. of* 21, *and* 30 *oz. of* 23 *carats fine.*

15. How much brass at 28 cts. and pewter at 21 cts. per lb. must I melt with 50 lb. of copper worth 32 cts. per lb. so that the whole mixture may stand in 24 cents per lb.

Ans. 50 *lb. at* 28 *cts. and* 200 *lb. at* 21 *cts.*

16. Suppose it required to reduce 63 gallons of brandy, at $1 30 cts. per gallon, to the price of $1 8 cts. per gallon? What quantity of water would it take ?

Ans. $12\frac{90}{108}$ *gallons.*

17. A merchant would mix 3 sorts of wine of different prices, viz : one at 6*s*. per gallon, another at 8*s*. a third at 11*s*. with 49 gallons at 15*s*. per gallon, that the mixture may stand in 13*s*. per gallon : How much wine at 6*s*. 8*s*. and 11*s*. per gallon will it take ? *Ans.* 7 *gallons of each sort.*

18. An innkeeper would, with 72 bushels of his best grain, at 80 cts. per bushel, mix other grain at 64 cts. at 48 cts. and 32 cts. per bushel: What quantity of the last three qualities must he take, that the mixture may be worth 56 cents per bushel ?

Answers.
- 24 *bushels each at* 64 *and* 48 *cts.* 72 *bush. at* 32 *cts.*
- 216 *bushels each at* 64 *and* 48 *cts.* 72 *bush. at* 32 *cts.*
- 18 *bush. at* 64, 72 *bush. at* 48, *and* 54 *bush. at* 32 *cts.*
- 96 —— *at* 64, 24 —— *at* 48, *and* 96 *bush. at* 32 *cts.*
- 54 *bushels each at* 64 *and* 48 *cts.* 72 *bush. at* 32 *cts.*
- 288 ———— *at* 64 *and* 48 *cts.* 72 *bush. at* 32 *cts.*
- 72 *bushels of each sort.*

19. How much gold of 15 and 17 carats fine, must be mixed with 5 oz. of 18, and 13 oz. of 22 carats fine, that the composition may be 20 carets fine ? *Ans.* 2 *oz. of each sort.*

N. B. Previous to the operation, the two given quantities must be supposed to be mixt by themselves ; and the rate found by alligation medial.

20. A wine merchant would, with 10 gallons of wine, at 12*s*. per gallon, and 20 gallons at 15*s*. per gallon, mix other wines, at 18*s*. and at 20*s*. per gallon : What quantity of the last two must he take that the mixture may be worth 16*s*. per gallon ? *Ans.* 10 *gallons of each sort.*

ALLIGATION TOTAL.

Alligation Total, is when the price of each simple is given, as also the mean rate, and the proposed quantity of the compound, *to find* how much of each sort will make that quantit

RULE—After linking the branches, and taking the differences as before, say, as the sum of these differences : is to the proposed quantity of the compound : : so is each particular difference : to its particular quantity.

EXAMPLES.

21. A vintner would mix wines at 8*s*. and 7*s*. per gallon, with cider at 1*s*. per gallon, so that the mixture may contain 26 gallons, and be worth 5*s*. per gallon : What quantity of each must he take ?

Ans. 8 *gal. at* 8*s*. 8 *at* 7*s*. *and* 10 *at* 1*s*. *per gallon.*

22. A retailer has by him 4 sorts of tea, viz : of 5*s*. 6*s*. 8*s*. and 9*s*. per lb. out of these, he is ordered to make up a chest containing neat a hundred and a half, so as to be worth 7*s*. per lb. In what proportion must those teas be taken ?

Ans. 28 *lb. at* 5*s*. 56 *lb. at* 6*s*. 56 *lb. at* 8*s*. 28 *lb. at* 9*s*. *per lb.*

23. A goldsmith has several sorts of gold, viz. No. 1 of 24 carats fine, No. 2 of 22 carats fine, No. 3 of 18 carats fine, and No. 4 of 16 carats fine ; How much of each sort must he take, to make a mass of 60 ounces, of 21 carats fine.

Ans. 25 *oz. of* 24 *carats,* 15 *oz. of* 22 *carats,* 5 *oz. of* 18 *carats,* 15 *oz. of* 16 *carats fine.*

24. A druggist had three sorts of indigo, one sort was worth 48 cents per lb. another 60 cts. and another 96 cts. and out of these he made up a parcel of 21 lb. at 72 cents per lb. and another parcel of 35 lb. at 84 cts. per lb : how much of every sort did he put in each parcel ?

Ans. $\left\{\begin{matrix} lb. \\ 6 \\ 6 \\ 9 \end{matrix}\right\}$ at $\left\{\begin{matrix} cts. \\ 48 \\ 60 \\ 96 \end{matrix}\right\}$ per lb. *Ans.* $\left\{\begin{matrix} lb. \\ 5 \\ 5 \\ 25 \end{matrix}\right\}$ at $\left\{\begin{matrix} cts. \\ 48 \\ 60 \\ 96 \end{matrix}\right\}$ per lb.

25. Brandy at 7*s*. and 11*s*. 6*d*. per gallon, is so to be mixed that a hhd. of 63 gallons may be sold for 25*l*. 4*s*. Quere the quantity of each sort ?

Ans. 49 *gallons at* 7*s*. 14 *gallons at* 11*s*. 6*d*. *per gallon.*

26. A silversmith has silver of 11½ oz. fine, and of 7 oz. fine and has orders to make up a piece of work, requiring 35 lb. of 9¼ oz. fine ; how much must he take of each ? *Ans.* 21 *lb.* 4 *oz.* 13 *dwt.* 8 *grs. of* 11½ *oz.* 13 *lb.* 7 *oz.* 6 *dwt.* 16 *gr. of* 7 *oz. fine.*

27. A grocer has three sorts of sugar, viz. of 12*d*. 11*d*. and 9*d*. per lb. now he wants to fill a tierce of 600 lb. so that he may sell it at 10*d*. per lb : what quantity of each must he take ?

Ans. 120*lb. at* 12*d*.—120*lb. at* 11 *d*.—360*lb. at* 9*d*. *per lb.*

28. Suppose 9 lb. of pure gold immersed in a vessel full of water to expel 3 lb. of water, 9 lb. of pure silver to expel 6lb. of water, and 9 lb. of a mass made up of gold and silver to

expel 4 lb. of water; required the quantity of gold and silver in the said mass?

	lb.		Ans.	
4	3	2	6 lb. of pure gold	in the mass.
	6	1	3 lb. of pure silver	

Hence is solved the famous question with respect to the crown of Hiero, King of Syracuse.—He had ordered a crown to be made of pure gold: but suspecting that the founder had mixed silver or copper with the gold, he desired Archimedes to examine, and tell him how much gold and how much alloy was in the crown. Archimedes by immersing the crown, and the like quantities of pure gold and silver, in water severally, and observing the respective quantities of water expelled, found an answer to the question.

POSITION.

Position is a rule that by false or supposed numbers taken at pleasure, discovers the true ones required, it is divided into two parts single and double.

SINGLE POSITION.

Single position by supposing one number taken at adventure, and working with it, according to the nature of the question, as if it were the true number, the true number is discovered.

RULE—As the result of the position : is to the position : : so is the given number : to the number required.

EXAMPLES.

1. What number is that, which being increased by $\frac{1}{2}$, $\frac{1}{3}$ and $\frac{1}{4}$ of itself, the sum shall be 125? *Ans.* 60.

2. Five-sixths of a certain number exceed three-fourths by 5; what is the number? *Ans.* 60

3. One being asked his age, replied, if $\frac{2}{5}$ of the years I have lived be multiplied by 7, and $\frac{5}{7}$ of this product be divided by 3, the quotient will be 20: what was his age? *Ans.* 30 *years.*

4. A General after sending out a foraging $\frac{1}{2}$ and $\frac{1}{3}$ of his men, had yet 700 remaining: what number had he in command? *Ans.* 4200

A gentleman distributed 78 cents among a number of poor people, consisting of men, women and children; to each man he gave 6 cents, to each woman 4, and to each child 2: moreover there were twice as many women as men, and thrice as many children as women: How many were there of each? *Ans.* 3 *men,* 6 *women, and* 18 *children.*

6. A Father divided his fortune among his sons, giving A. 7, as often as B. 4; to C. he gave as often 2, as B. 5; and yet

the dividend of C. came out 2166*l.* 7*s.* 6*d.* what was the value of the whole fortune? *Ans.* 17060*l.* 4*s.* $0\frac{3}{4}$*d.*

7. There is a cistern with 3 unequal pipes, containing 600 gallons of water; and if the greatest pipe be opened the cistern will be empty in one hour; if the second pipe be opened it will be empty in two hours; if the third be opened it will be empty in three hours: required the time it will take to empty if all run together? *Ans.* $32\frac{8}{11}$ *min.*

8. Peter drinks a barrel of beer containing 32 gallons in 24 days, and Charles when he goes about it, does it in 16 days; now if they should drink together, in what time will they make an end of it? *Ans.* 9 *days* $14\frac{2}{5}$ *hours.*

9. Suppose I lend at interest a certain sum of money, at the rate of 8 per cent. per annum, simple interest, and that at the end of 10 years, I received both for principal and interest $1539. I demand the principal sum lent? *Ans.* $855.

DOUBLE POSITION.

Double Position, is by making use of two supposed numbers, and if both prove false (as generally happens) proceed with them and their errors according to the following

RULE.—Place each error against its respective position, and multiply them cross-wise. If the errors are alike, that is, both greater (marked +) or both less, (marked—) than the given number, take their difference for a divisor, and the difference of their products for a dividend. But if unlike, that is, one too much, and the other too little, then take their sum for a divisor, and the sum of their products for a dividend, the quotient will be the answer.

EXAMPLES.

1. What number is that which being increased by 30 is equal to 6 times the same lessened by 45? *Ans.* 15.

2. Three persons discoursed together concerning their ages; says A. I am 20 years of age; says B. I am as old as A. and half C; and says C. I am as old as you both: I demand each of their ages? *Ans. A. was* 20, *B.* 60, *C.* 80 *years old.*

3. A. B. and C. found a bag containing a certain number of dollars, and when they divided the booty, A and B's share amounted to $47; B. and C's to $88; and A. and C's to $71 required the amount of the sum found, and each man's share thereof? *Ans. found* $103, *A's share* $15, *B's* $32, *C's* $56.

4. A certain man having driven his swine to market, viz. hogs, sows, and pigs, received for them all $250, being paid for every hog $4½, for every sow $4, and for every pig 50 cents—there were as many hogs as sows, and for every sow

there were three pigs: I demand how many there were of each? *Ans. 25 hogs, 25 sows, and 75 pigs.*

5. A. and B. settling accounts found, that if 6*l.* were added to $\frac{2}{5}$ of A's bill, and the same sum taken from $\frac{2}{3}$ of B's, the sum would be $\frac{7}{8}$ of the remainder; and that the sum and remainder added together made 72*l.* I demand each person's bill? *Answer, A's* 41*l.* 8*s.*—*B's* 66*l.* 12*s.*

6. A son asked his father how old he was, his father replied, your age is now $\frac{1}{3}$ of mine; but 4 years ago, your age was only $\frac{1}{7}$ of what mine is now: what were their ages?
Ans. 70 years the father, 14 the sons.

7. A gentleman finding several beggars at his door, gave to each 4 cents, and had 16 left: but if he had given to each 6 cents, he would have wanted 12: how many beggars were there? *Answer* 14

8. A merchant has 100 bushels of wheat and barley, which cost him 46*l.* 10*s.* the wheat stands him in 12*s.* per bushel, and the barley 6*s.* required the number of bushels he has of each? *Ans. 55 of wheat, 45 of barley.*

9. A gentleman had two horses, Chesnut and Swift, and a saddle worth 50*l.* which set on the back of Chesnut, makes his value double that of Swift: but the saddle set on the back of Swift, makes his value triple that of Chesnut; what was the value of each horse? *Ans. Chesnut* 30*l.* *Swift* 40*l.*

10. There was a fish caught whose head was $7\frac{1}{4}$ inches long, its tail was as long as the head and half the body, and the body was exactly the length of both head and tail: how long was the whole fish? *Ans.* 62 *inches.*

11. There is an army to which if you add $\frac{1}{6}$, $\frac{1}{3}$ and $\frac{1}{4}$ of itself and take away 5000, the sum total will be 100000: what is the number of the whole army? *Ans.* 50400

12. A. and B. have the same income; B. saves $\frac{1}{7}$ of his; but B. by spending $75 per annum more than A. at the end of 8 years finds himself $100 in debt: What is their income, and what does each spend per annum?
Ans. Their income is $500 per ann. A. spends $437½. B. spends $512½ per annum.

13. A. and B. laid out equal sums of money in trade; A. gained a sum equal to $\frac{1}{4}$ of his stock, and B. lost $562½, then A's money was double that of B's. What did each lay out? *Ans.* $1500.

14. If to my months you should add half this sum,
And one-eighth more, and then should subtract one,
The residue would such a number be
As twenty-one being squared assuredly?
Ans. 22 years, 8 mo

15. When first the marriage knot was tied
Betwixt my wife and me,
My age did her's as far exceed,
As three times three does three;
But after ten and half ten years,
We man and wife had been,
Her age came up as near to mine,
As eight is to sixteen.
Now, Tyro, skill'd in numbers, say,
What were our ages on the wedding-day?

Answer.

Sir, forty-five years you had been,
Your bride no more than just fifteen.

16. A man overtaking a maid driving a flock of geese, said to her, how do you do, sweetheart? Where are you going with these 100 geese? No Sir, said she, I have not 100; but if I had as many, half as many, and seven geese and a half, I should have 100: How many had she? *Ans.* 37.

17. A surly old fellow being demanded the ages of his 4 sons, answered, you may go and look; but if you must needs know, my first son was born just 1 year after I was married to his mother, who after his birth, lived 5 years, and then died in child-bed with my second; 4 years after that I married again, and within 2 years had my third and fourth sons at a birth; the sum of whose ages together is now equal to that of the eldest: I demand their several ages?

Ans. 22 *years* 1*st son*, 17 *years* 2*d*, 11 *years each the* 3*d and* 4*th son.*

18. Old John, who had in credit liv'd,
Tho' now reduc'd, a sum receiv'd,
This lucky hit's no sooner found,
Than clam'rous Duns came swarming round;
To th' landlord—baker—many more,
John paid in all, pounds ninety-four.
Half what remain'd—a friend he lent,—
On Joan and 'self, one-fifth he spent;
And when of all these sums bereft,
One-tenth o'th' sum received had left:
Now shew your skill, ye learned youths,
And by your work the sum produce. *Ans.* 141*l.*

19. A young gentleman, at the age of 21 years, was told by his guardian, that his fortune consisted in cash, to the amount of $35129, and that his father died when he was but 10 years old, and the money your father left, said the guardian, I have allowed you 6 per cent. per annum for simple interest, only I have deducted $300 per annum for your education, &c. What was the son's fortune that was left by his father?

Answer, $23150.

PART IV.

A TABLE OF POWERS.

Roots,	Squares,	Cubes,	4th pow.	5th pow.	6th pow.	7th pow.
1	1	1	1	1	1	1
2	4	8	16	32	64	128
3	9	27	81	243	729	2187
4	16	64	256	1024	4096	16384
5	25	125	625	3125	15625	78125
6	36	216	1296	7776	46656	279936
7	49	343	2401	16807	117649	823543
8	64	512	4096	32768	262144	2097152
9	81	729	6561	59049	531441	4782969

SQUARE ROOT.

Extracting the Square Root is to find out such a number being multiplied into itself, the product will be equal to e given number.

RULE.—*First*, Point the given number, beginning at the its place, then at the hundreds, and so upon every second ure both ways, if there be an odd figure in the decimal, nex a cipher.

Secondly, Find the *greatest square* in the left hand period, d place the root in the quotient, subtract the square from e period, and to the remainder bring down the next period a dividend.

Thirdly, Double the quotient, or add the last figure to the t divisor, which will be the new divisor; and try how of- it will be contained in the dividend, putting the trial fig- e for the unit's place in the divisor, and when found near- , put it in the quotient, then multiply and subtract the oduct from the dividend, bring down the next period to the nainder (if there be any more, or add ciphers) and proceed before.

EXAMPLES.

1. Required the square root of 133225.

```
                133225(365 root.                    365
                  9                                 365
                ------                            ----
first divisor  66 | 432 first dividend.            1825
                6 | 396 first product             2190
                ---------                        1095
second divisor 725 | 3625 second dividend.        ------
                 5 | 3625 second product.        133225 proof.
                ---------
                  ....
```

2. Required the square root of 54990.25? *Ans.* 234.5
3. Required the square root of .2916? — .54
4. Required the square root of 3? — 1.73205
5. Required the square root of 7? — 2.645751
6. Required the square root of 10? — 3.162277
7. Required the square root of .001225? — .035
8. Required the square root of .00032754? — .01809
9. Required the square root of 4.000067121? — 2.000016

REPEATING AND CIRCULATING DECIMALS.

RULE—Instead of ciphers, annex periods of the repeating or circulating figures.

EXAMPLES.

10. Required the square root of $.\dot{1}$? *Ans.* $.\dot{3}$
11. Required the square root of $.\dot{4}$? — $.\dot{6}$
12. Required the square root of $1320.\dot{1}$? — $36.\dot{3}$
13. Required the square root of $138.\dot{5}1\dot{8}$? — 11.769389

VULGAR FRACTIONS.

RULE—Reduce the fraction to its lowest terms, then extract the square root of its numerator and denominator, for a new numerator and denominator; but if the fraction be surd reduce it to a decimal, and then extract the root. A mixed number may be reduced to an improper fraction, or decimal.

EXAMPLES.

14. Required the square root of $\frac{2704}{4225}$? *Ans.* $\frac{4}{5}$.
15. Required the square root of $\frac{9216}{12544}$? — $\frac{6}{7}$.
16. Required the square root of $\frac{357}{476}$? — .86602
17. Required the square root of $\frac{478}{849}$? — .93308
18. Required the square root of $51\frac{21}{25}$? — $7\frac{1}{5}$.
19. Required the square root of $9\frac{43}{49}$? — $3\frac{1}{7}$.

Required the square root of $8\frac{4}{7}$? — 2.9519.

[illegible]quare root of $6\frac{4}{5}$? — 2.5819.

QUESTIONS FOR EXERCISE.

22. A certain number of men gave $789 61 cents for a charitable purpose, each man giving as many cents as there were men: quere their number? *Ans.* 281

23. If 1369 fruit trees be planted in a square orchard, how many must be in a row each way? *Ans.* 37.

24. There are two numbers, whereof the lesser is 3456, their difference is 293392: what is the greater, and what the square root of their sum? Ans. the greater is 296848, and the square root of their sum 548.

25. There is an army consisting of a certain number of men who are placed rank and file that is in the form of a square, each side having 432 men: required the number? *Ans.* 186624.

PROBLEMS.

I. *To find a mean proportional between any two given numbers.*

RULE—The square root of the product of the given numbers, is the mean proportional sought.

EXAMPLES.

26. Required the mean proportional between 3 and 12? *Ans.* 6.

27. Required the mean proportional between 4276 and 842? *Ans.* 1897.469.

II. *To find the side of a square equal in area to any given superfices.*

RULE—The square root of the given superfices, is the side sought.

EXAMPLES.

28. If the content of a given circle be 160, required the side of the square equal thereto? *Ans.* 12.64911.

29. Suppose I have an elliptical fish pond containing 9 acres, 2 roods, 15 poles, and would have a square one of the same content: Required the length of each side? *Ans.* 215.484918 *yards.*

III. *Having the area of a circle to find the diameter.*

RULE—As 355 : 452 : : or, as 1 : 1·273239 : : so is the area : to the square of the diameter : or multiply the square root of the area by 1.12837, and the product will be the diameter.

EXAMPLES.

30. Required the diameter of that circle whose area is 82 feet 84 inches? *Ans.* 10 feet. 6 inch.

31. In the midst of a meadow,
Well stored with grass;
I've taken just two acres,
To tether my ass:
Then how long must the cord be,
That feeding all round;
He mayn't graze less or more, than
Two acres of ground.

Ans. 55½ *yards.*

IV. *The area of a circle given to find the circumference.*

RULE—As 113 : 1420, or, as 1 : 12.56637 : : the area : to the square of the circumference, or periphery : or, multiply the square root of the area by 3.5449, and the product is the circumference.

EXAMPLES.

32. Required the circumference of that circle whose area is 12? *Ans.* 12.2798.

33. When the area is 160 perches, required the circumference? *Ans.* 44.839.

V. *Any two sides of a right angled triangle, to find the third side.*

1st. *The base and perpendicular given to find the hypothenuse.*

RULE—The square root of the sum of the squares of the base and perpendicular, is the length of the hypothenuse.

2d. *The hypothenuse and one side given to find the other side.*

RULE—From the square of the hypothenuse, subtract the square of the given side, the square root of the remainder is the side required.

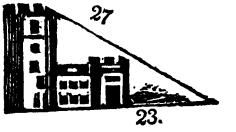
EXAMPLES.

34. At Matlock, near the Peak in Derbyshire, where are many surprising curiosities in nature, is a rock by the side of the river Derwent, rising perpendicular to a wonderful height, which being inaccessible, I endeavoured to measure, and found by a mathematical method, that the distance between the place of observation and the foot of the rock to be 55½ yards, and from the top of the rock to the said place, to be 140½ yards: Required the height [illegible] tedious work.

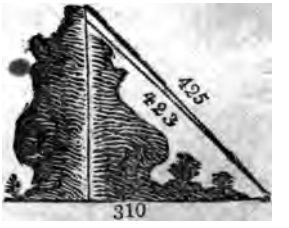
[illegible] 129.07 yards.

35. A ladder 40 feet long may be so planted, that it shall reach a window 33 feet from the ground on one side the street, and, without moving it at the foot, will do the same by a window 21 feet high on the other side: the breadth of the street is required? *Ans.* 56.64 *feet.*

36. A line 27 yards long, will exactly reach from the top of a fort, on the opposite bank of a river known to be 23 yards broad: the height of the wall is required. *Ans.* 14.142 *yds.*



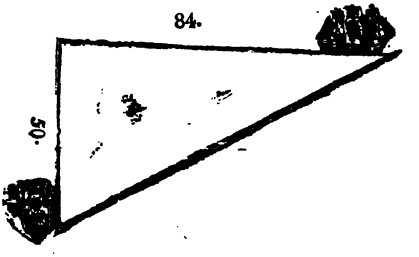
37. Suppose a light-house built on the top of a rock, the distance between the place of observation and that part of the rock level with the eye, and directly under the building, is given 310 fathoms; the distance from the top of the rock to the place of observation is 423 fathoms; and from the top of the building 425: the height of the edifice is required.



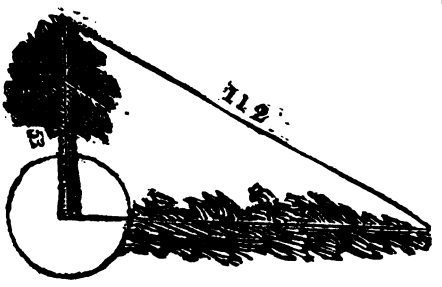
Ans. 287.80027 *fathoms the height of the rock,* 2.93156 *fathom*=17 *feet,* 7 *inches, the height of the light-house.*

38 Two ships set sail from the same port, one of them sails due east 84 leagues, the other due south 50: How far are they asunder.

Ans. 97.75= 97¾ *lea. the dist. required.*



39. The height of an Elm, growing in the middle of a circular island 30 feet in diameter, plumbs 53 feet, and a line stretched, from the top of the tree straight to the hither edge of the water, 112 feet: What then is the breadth of the moat, supposing the land on the other side the water to be level. *Ans.* 83 ft. 8 in.



CUBE ROOT.

To extract the Cube Root is to find out a number, which being multiplied into itself, and then into that product produceth the given number.

Rule 1st.—Divide the given number into periods of three figures, beginning at the units place, then find the highest cube to the first period, and subtract it therefrom, put the root in the quotient, and bring down the next period to the remainder for a dividend.

2d. Square the quotient, and multiply it by 300 for a trial divisor. Find how often it is contained in the dividend, and put the result in the quotient.

3d. Multiply the former quotient by 30, and the product by the figure last—put in the quotient for the second part of the divisor.

4th.—Square the last figure in the quotient for the remaining part of the divisor; the sum of these three parts will be the divisor complete, which multiply by the figure last put in the quotient, subtract the product from the dividend, bring down the next period, and proceed as before.

EXAMPLES.

1. Required the cube root of 15625.

15625(25 root.
8

1st part of the divis. $=2\times2\times300=1200$
2d part of the divis. $=2\times30\times5=300$
3d part of the divis. $=5\times5 - - = 25$

7625 the dividend

The divisor complete $=1525\times5=7625$ the product

2. Required the cube root of 99252847? *Ans.* 463.
3. Required the cube root of 259694072? — 638.
4. Required the cube root of 7612.812161? — 19.67
5. Required the cube root of 61218.00121? — 39.41
6. Required the cube root of 219365327.791? — 603.1
7. Required the cube root of 67527834239? — 4072.18.
8. Required the cube root of 36155.027576? — 33.0365.
9. Required the cube root of .0069761218? — .19107.

VULGAR FRACTIONS.

RULE—The same as given in the Square Root, page 122, only observe to extract the Cube Root instead of the Square Root.

EXAMPLES.

10. Required the cube root of $\frac{324}{1500}$? *Ans.* $\frac{3}{5}$.
11. Required the cube root of $\frac{1520}{5136}$? — $\frac{2}{3}$.
12. Required the cube root of $\frac{4}{7}$? — .829.
13. Required the cube root of $\frac{2}{3}$? — .873.
14. Required the cube root of $12\frac{19}{27}$? — $2\frac{1}{3}$.
15. Required the cube root of $405\frac{28}{125}$? — $7\frac{2}{5}$.
16. Required the cube root of $9\frac{1}{6}$? — 2.092.
17. Required the cube root of $8\frac{5}{7}$? — 2.057.

QUESTIONS FOR EXERCISE.

18. If a cubical piece of timber be 47 inches long, 47 inches broad, and 47 inches deep: What is the contents in cubical inches? *Ans.* 103823.

19. There is a cellar dug, that is $12\frac{1}{2}$ feet every way in length, breadth, and depth: how many cubical feet of earth were taken out of it? *Ans.* 1953.125.

20. There is a stone of a cubic form, which contains 389017 solid feet: Required the superficial content of one of its sides? *Ans.* 5329.

21. There are two numbers, whereof the greater is 2579890752, their difference is 1152: What is the lesser, and what the cube root of their sum? *Ans.* The lesser 2579889600, and the cube root of their sum is 1728.

PROBLEMS.

I. *To find two mean proportionals between two given numbers.*

RULE—Divide the greater extreme by the less, and the cube root of the quotient multiplied by the less extreme gives the less mean; multiply the said cube root by the less mean, and the product will be the greater mean proportional.

EXAMPLES.

22. What are the two mean proportionals between 7 and 189? *Ans.* 21 and 63.

23. Required two mean proportionals between 4 and 256? *Ans.* 16 and 64.

II. *To find the side of a cube that shall be equal in solidity to any given solid, as globe, cylinder, prism, &c. &c.*

RULE—The cube root of the solid content of any solid body given, is the side of the cube of equal solidity.

EXAMPLES.

24 If the solid content of a globe be 10648: What is the side of a cube of equal solidity? *Ans.* 22.

25. Required the side of a cubical vessel that shall contain 80 wine gallons, each 231 cubic inches? *Ans.* 26.43 *in.*

III. *The side of the cube being given, to find the side of the cube that shall be double, treble, &c. in quantity to the given cube.*

RULE—Cube the given side, and multiply it by 2, 3, &c. the cube root of the product is the side sought.

EXAMPLES.

26. There is a cubical vessel, whose side is 12 inches, it is required to find the side of another vessel, that shall contain three times as much? *Ans.* 17.306

27. Suppose the length of a ships keel to be 125 feet, the breadth of the midship beam 25 feet, and the depth of the hold 15 feet; required the dimensions of another ship of the same form, that shall carry three times the burthen?

Ans. { *Length of the keel* 180.28 *feet.*
Breadth of the beam 36.05 *feet.*
Depth of the hold 21.63 *feet.* }

IV. *Having the dimensions and capacity of a solid, to find the dimensions of a similar solid of a different capacity.*

RULE—Like solids are in triplicate proportion to their homologous sides, therefore it will be as the cube of a dimension: is to its given weight : : so is the cube of any like dimension : to the weight required.

EXAMPLES.

28. A brass bullet of 5 inches diameter weighs 20 lb: required the diameter of a like bullet that weighs 160 lb. *Ans.* 10 *inches.*

29. If a ship of 300 tons burthen, be 75 feet long in the

keel: I demand the burthen of another ship, whose keel is 100 feet long? *Ans.* 711.111 *tons.*

30. If a brass saker, whose diameter is 11.5 inches, weighs 1000 lb. what will another piece of ordnance (of the same metal and shape) weigh, whose diameter is 20.83 inches? *Ans.* 5942.5697 lb.

BIQUADRATE ROOT.

RULE—Extract the square root of the square root.

ROOT OF THE SIXTH POWER.

RULE—Extract the cube root of the square root.

ROOT OF THE EIGTH POWER.

RULE—Extract the square root, of the biquadrate root.

ROOT OF THE NINTH POWER.

RULE—Extract the cube root of the cube root.

TO EXTRACT ANY ROOT WHATEVER.

RULE—Let P be the given power or number, n the index of the power, A the assumed power, r its root, R the required root of P.

Then, as the sum of $n+1$ times A, and $n-1$ times P: is to the sum of $n+1$ times P and $n-1$ times A :: so is the assumed root r: to the required root R.

Note—For greater exactness the operation may be repeated as often as we please, by using always the last found root for the assumed root, and its n'th power for the assumed power A.

EXAMPLES.

1. Required the sursolid, or 5th root 21035.8?

The fifth root is found to be between 7.3 and 7.4.

The 5th power 7.3=20730.71593. Hence P=21035.8, $n\times5$, r=7.3 and A=20730.71593

$n+1\times$A=124384.29558 $n+1\times$P=126214.8

$n-1\times$P= 84143.2 $n-1\times$A=82922.86372

208527.49558	:	209137.76372	::	7.3 : 7.32136
2. Required the 4th root of 2?			*Ans.*	1.189207
3. Required the 5th root of 2?			—	1.148699
4. Required the 6th root of 2?			—	1.122462
5. Required the 7th root of 2?			—	1.104089
6. Required the 7th root of 21035.8?			—	4.145392

ARITHMETICAL PROGRESSION.

Arithmetical Progression is a rank, or series of numbers, *which increase or decrease* by common difference; in which *five particulars* are to be observed, viz:

Let f, represent the first term, } called extremes.
l, ——— the last term, }
n, ——— the number of terms.
d, ——— the equal or common difference.
s, ——— the sum of all the terms.

Note—In any series of numbers in Arithmetical Progression, the sum of the two extremes will be equal to the sum of any two terms equally distant therefrom; as 2, 4, 6, 8, 10, 12; where $2+12=14$; so $4+10=14$; or 3, 6, 9, 12, 15; where $3+15=18$; also $6+12=18$; and also $9+9=18$.

I. *Given f. l. and n. to find s.*——RULE. $f+l\times\frac{n}{2}=s$.

EXAMPLES.

1. How many times does the hammar of a clock strike in 12 hours. *Ans.* 78.

2. A man buys 17 yards of Osnaburgh, and gave for the first yard 2*s*. and for the last 10*s*. Quere, the amount of the whole? *Ans.* 5*l*. 2*s*.

3. A butcher bought 100 head of oxen, and gave for the first ox 1 crown, for the second, 2 crowns, for the third, 3 crowns, &c. Quere, the sum paid for the cattle.
Ans. 1262*l*. 10*s*.

4. Suppose a basket and 500 stones were placed in a straight line a yard distant from one another: Required in what time a man could bring them one by one to the basket, allowing him to walk at the rate of 3 miles an hour?
Ans. 142.329 *miles.—and* 47 *ko.* 26 *m.* 34.8 *s.*

II. *Given f. l. and n. to find d.*——RULE. $\frac{l-f}{n-1}=d$.

EXAMPLES.

5. A man had 8 sons, the youngest was 4 years old, and the eldest 32, they increase in arithmetical progression: Required the equal difference of their ages? *Ans.* 4.

6. A man is to travel from Washington to a certain place in 12 days, and to go but 3 miles the first day, increasing every day an equal excess, so that the last day's journey may be 58 miles: Required the daily increase, and distance from Washington? *Ans.* 5 *daily increase, and distance* 366 *m.*

III. *Given f. l. and d. to find n.*——RULE. $\frac{l-f}{d}+1=n$.

EXAMPLES.

7. A person travelling into the country, went 3 miles the first day, and increased every day by 5 miles, till at last he went 58 miles in one day: How many days did he travel.
Ans. 12.

8. A man being asked how many sons he had, said, that the youngest was 4 years old, and the oldest 32, and that his family increased one every 4 years: How many had he? *Ans.* 8.

IV. *Given l. n. and d. to find f.*——RULE. $l-\overline{d\times\overline{n-1}}=f.$

EXAMPLES.

9. A man in 10 days went from New-York to a certain town in the country, every day's journey increasing the former by 4, and the last he went was 46 miles. What was the first? *Ans.* 10 *miles.*

10. A man takes out of his pocket at eight several times, so many different numbers of dollars, every one exceeding the former by 6, the last at 46. What was the first? *Ans.* $4.

V. *Given, n. d. and s. to find f.*——RULE. $\frac{s}{n}-\frac{d\times\overline{n-1}}{2}=f.$

EXAMPLE.

11. A man is to receive 360 eagles, at 12 several payments, each to exceed the former by 4 eagles, and is willing to bestow the first payment on any one that can tell him what it is. What will that person have for his pains? *Ans.* 8 *eagles.*

VI. *Given, f. n. and d. to find l.*——RULE. $\overline{n\times d}-d+f=l.$

EXAMPLE.

12. Required the last number of an arithmetical progression, beginning at 6, and continuing by an increase of 8 to 20 places? *Ans.* 158.

GEOMETRICAL PROGRESSION.

Geometrical Progression is a series of numbers increasing or decreasing by one continual multiplier or divisor, called the ratio; as, 2, 4, 8, 16, 32, &c. increase by the continual multiplication of 2; and 32, 16, 8, 4, 2, decrease continually by the divisor 2.

I. *When the first term is unity, the ratio and number of terms being known, to find the last.*

RULE—Raise such a power of the ratio, multiplied into the first term; or, take a convenient number of terms (called indices) in Arithmetical Progression, beginning and increasing with an unit, under which, place the leading terms, of the given Geometrical Progression; then the square of any term under an indice, will be the term represented by twice that indice, &c.

If the first term and ratio be different, begin the indices *with a cipher,* and the sum which is to be made choice of,

must be always one less than the number of terms given in the question, as 1 in the indices stands over the second term.

EXAMPLES.

1. A boy agrees for 16 oranges, to pay only the price of the last, reckoning a cent for the first, two cents for the second, four cents for the third, &c. doubling the price to the last: How much did he give for them? *Ans.* $327.68.

2. A butcher meets with a drover who had 23 oxen; he demanded the price of them, and was answered 16*l.* a head: the butcher bids him 15*l.* a head, and would take all: the drover tells him it could not be taken; but if he would give what the last ox would come to, at a farthing for the first, and doubling it to the last, he should have all: Required the price of the oxen? *Ans.* 4369*l.* 1*s.* 4*d.*

II. *In any series, not proceeding from unity, the ratio and first term being given, to find any remote term.*

RULE—Proceed as in the last case, only observe to divide every product by the first term, and the quotient will be the term required.

EXAMPLES.

3. A sum of money is to be divided among 8 persons, the first to have $20, the second $60, and so on in triple proportion: What will the last have? *Ans.* $43740.

4. A gentleman dying left nine sons, to whom and to his executors, he bequathed his estate in manner following, viz: To his executors 50*l.* his youngest son was to have as much more as the executors, and each son to exceed the next younger by as much more: What was the eldest son's fortune? *Ans.* 25600*l.*

III. *When the first term, ratio, and number of terms are given, to find the sum of all the terms.*

RULE—Find the last term as before, from which subtract the first, divide the remainder by the ratio, less one, and to that quotient add the last term, gives the sum required.

EXAMPLES.

5. A man bought a horse, and by agreement was to give a farthing for the first nail, three for the second, &c. there were four shoes, and in each shoe 8 nails: What was the amount of the horse? *Ans.* 9651146816931*l.* 13*s.* 4*d.*

6. A gentleman married his daughter on New-Year's day, and gave her husband an English guinea towards her fortune, promising to double it on the first day of every month for one year. What was her fortune in federal money? *Ans.* $19110.

A miller buys 12 stacks of wheat, and was to pay 2

cents for the first stack, 6 cents for the next stack, tripling the price for every following stack: What sum did he pay?
Ans. $5314.40.

8. A grain of wheat being sown, produces 7 grains, which are sown again and yield the same increase: Required how much it will amount to in 12 years, if the whole crop be always sown and yield the same increase? and how many bushels, allowing 700000 grains to a bushel?
Ans. 13841287201 *grains*, 19773 *bushels*.

9. If the posterity of Noah, which consisted of six persons at the flood, increased so as to double their number in 20 years, how many inhabitants would there be in the world two years before the death of Shem, who lived 502 years after the flood? *Ans.* 201326592.

10. The Indian who invented the game of chess, is said to have asked of the King, who promised him any reward he should demand, that he might have one grain of wheat for the first point of the board, two for the second, and so on, in geometrical progression for all the 64 points. The King considering that as a small matter, ordered the wheat to be given him. How much will it amount to?
Ans. { 18446744073709551615 *grains*. 2635249153387 *bushels*.

IV. *Of any decreasing series in Geometrical Progression, whose last term is a cipher, to find the sum of those series.*

RULE—Divide the square of the first term by the difference between the said first term, and the second term in the series, the quotient will be the sum of the series.

EXAMPLES.

11. A great ship pursues a small one, steering the same way, at the distance of 4 leagues from it, and sails twice as fast as the small ship: Required how far the great ship must sail before it overtakes the lesser? *Ans.* 24 *miles*.

12. Suppose a ball to be put in motion by a force which drives it 12 miles the first hour, 10 the second, and so on continually decreasing in proportion of 12 to 10 to infinity: What space would it move through? *Ans.* 72 *miles*.

PERMUTATION.

Permutation is a rule for finding how many different ways any given number of things may be varied in position, thus, a b c, a c b, b a c, b c a, c a b, c b a, are 6 different positions of 3 letters.

RULE—Multiply all the terms of the natural, series continually, from one to the given number inclusive, the last product will be the changes required.

EXAMPLES.

1. In how many different positions can 6 persons place themselves at table? $1\times2\times3\times4\times5\times6=720$ *positions.*

2. Required the number of changes that may be rung on 12 bells, and the time in which they may be rung, allowing 3 seconds to every round? *Ans.* { 479001600 *changes.* / 45 *yrs.* 195 *days,* 18 *ho.*

3. What time will it require for 8 boarders to seat themselves every day differently at dinner? *Ans.* 110 *yrs.* 142 *days.*

4. How many variations will the 26 letters of the alphabet admit of? *Ans.* 403291461126605635584000000.

COMBINATION.

Combination discovers how many different ways a less number of things may be combined out of a greater; thus out of the numbers, 7, 8, 9, are 3 different combinations of 2, viz: 78, 79, 89.

RULE—Take a series proceeding from, and increasing by one, up to the number to be combined; and another series of as many places, decreasing by one, from the number out of which the combinations are to be made; multiply the first continually for a divisor, and the latter for a dividend; the quotient will be the answer.

EXAMPLES.

1. How many combinations of 5 letters in 10?

$$\frac{10\times9\times8\times7\times6}{1\times2\times3\times4\times5}=252 \textit{ Answer.}$$

2. A General who had often been successful in war, was asked by his King what reward he should confer upon him for his services; the general only desired a farthing for every file, of 10 men in a file, which he could make with a body of 100 men: Required the amount in pounds sterling?

Ans. 180315723 50*l.* 9*s.* 2*d.*

3. How many different ways may a butcher choose 50 sheep out of a flock consisting of 100, so as not to make the same choice twice? *Ans.* 108913065448740792571724972 56.

SIMPLE INTEREST BY DECIMALS.

Here are five letters to be observed, viz.

P, or p = any principal or sum put to interest.
I, or i = the interest.
T, or t = the time of the principal's continuance at interest
A, or a = the amount, or principal and its interest.
R, or [illegible] ratio, or rate per centum per annum.

[illegible] the simple interest of 1*l.* or £. for 1 [illegible] per cent and is thus found, viz.

$$\text{As}\begin{cases}\$100 : \$6 :: \$1 : \$.06 \text{ the ratio at 6 per cent. per annum.}\\ \$100 : \$5\tfrac{1}{2} :: \$1 : \$.055 \text{ the ratio at } 5\tfrac{1}{2} \text{ per cent. per annum.}\end{cases}$$

I. *Given p, t, and r, to find i.*——RULE. $p \times t \times r = i$.

EXAMPLES.

1. What is the interest of $567 50 cents for 9 years at 6 per cent per annum? *Ans.* $306 45 *cents.*

2. What is the interest of 172*l.* 10*s.* for 7 months at 7 per cent per annum? *Ans.* 7*l.* 0*s.* 10½*d.*

3. How much is the interest of $700 for 1 year and 73 days at 6 per cent per annum? *Ans.* $50 40 *cents.*

II. *Given p, t, and r, to find a.*——RULE. $p \times t \times r + p = a$.

EXAMPLES.

4. What will $584 33⅓ cents amount to in three years at 6 per cent per annum? *Ans.* $689 51⅓ *cents.*

5. What is the amount of 440*l.* for 7 years at 7 per cent per annum? *Ans.* 655*l.* 12*s.*

III. *Given r, t, and i, o find p.*——RULE. $\frac{i}{t \times r} = p$.

EXAMPLES.

6. I demand what principal, being put to interest for 9 years, will gain $306 45 cents at 6 per cent per annum? *Ans.* $567 50 *cents.*

7. I demand what principal, being put to interest for 7 months, will gain 7*l.* 0*s.* 10½*d.* at 7 per cent per annum? *Ans.* 172*l.* 10*s.*

IV. *Given a, r, and t, to find p.*——RULE. $\frac{a}{t \times r + 1} = p$.

EXAMPLES.

8. What principal being put to interest, will amount to $689 51⅓ cents in 3 years at 6 per cent per annum? *Ans.* $584⅓.

9. What principal being put to interest, will amount to 655*l.* 12*s.* in 7 years at 7 per cent per annum? *Ans.* 440*l.*

V. *Given, p, i, and r, to find t.* RULE. $\frac{i}{p \times r} = t$.

EXAMPLES.

10. In what time will $567 50 cents, gain $306 [illegible] at 6 per cent per annum? *Ans.* [illegible]

11. In what time will 172*l.* 10*s.* gain 7*l.* 0*s.* [illegible] *cent per annum?* *Ans.* [illegible]

VI. *Given, p, i, and r, to find t.* RULE. $\frac{a-p}{p\times r}=t.$

EXAMPLES.

12. In what time will $700 amount to $750 40 cents at 6 per cent per annum? *Ans.* 1 *year* 73 *days.*

13. In what time will 172*l.* 10*s.* amount to 179*l.* 10*s.* 10½*d.* at 7 per cent per annum? *Ans.* 7 *months.*

VII. *Given, p, i, and t, to find r.* RULE $\frac{i}{p\times t}=r.$

EXAMPLES.

14. At what rate per cent will $567 50 cents gain $306 45 cents in 9 years? *Ans.* 6 *per cent.*

15. At what rate per cent will 172*l.* 10*s.* gain 7*l.* 0*s.* 10½*d.* in 7 months? *Ans.* 7 *per cent.*

VIII. *Given, p, a, and t, to find r.*—RULE. $\frac{a-p}{p\times t}=r.$

EXAMPLES.

16. At what rate per cent will $700 amount to $750 40 cents in one year and 73 days? *Ans.* 6 *per cent.*

17. At what rate per cent will 172*l.* 10*s.* amount to 179*l.* 10*s.* 10½*d.* in 7 months? *Ans.* 7 *per cent.*

ANNUITIES OR PENSIONS, &c. IN ARREARS.

Annuities or Pensions, &c. are said to be in Arrears when they are payable or due, either yearly, half-yearly, or quarterly, and are unpaid for any number of payments.

Here u, represents the Annuity, Pension, or yearly rent, a, t, r, as before, and $\frac{2}{r}-1=x$.

I. *Given, u, r, and t, to find a.*—RULE. $\frac{\overline{t\times t\times u}-\overline{t\times u}}{2}\times r$ $:+t\times u=a.$

EXAMPLE.

18. If 250*l.* yearly rent, be forborne 7 years, what will it amount to in that time at 6 per cent? *Ans.* 2065*l.*

For exercise the scholar may work the same, payable in half-yearly, and quarterly payments.

Note—If the payments are made $\left\{\begin{matrix}\text{half-yearly}\\ \text{quarterly}\end{matrix}\right\}$ then use $\left\{\begin{matrix}\frac{1}{2}r, \frac{1}{2}u, \text{ and } 2t.\\ \frac{1}{4}r, \frac{1}{4}u, \text{ and } 4t.\end{matrix}\right.$

II. *Given, a, r, and t, to find u.*—RULE. $\frac{2a}{\overline{t\times t\times r}-\overline{t\times r}+2t}=u.$

EXAMPLE.

If a pension amount to 2065*l.* in 7 years, at 6 per cent. *Ans.* 250*l.*

Note—If the payments are made $\left\{\begin{matrix}\text{half-yearly}\\ \text{quarterly}\end{matrix}\right\}$ then use $\left\{\begin{matrix}4a, \frac{1}{2}r, \text{ and } 2t.\\ 8a, \frac{1}{4}r, \text{ and } 4t.\end{matrix}\right.$

III. *Given, u, a, and t, to find r.*—RULE. $\dfrac{2a - 2u \times t}{u \times t \times t - u \times t} = r.$

EXAMPLE.

20. If an annuity of $250 per annum, amounts to $2065 in 7 years: Required the rate per cent? *Ans.* 6 *per cent.*

Note—If the payments are made $\left\{\begin{matrix}\text{half-yearly}\\ \text{quarterly}\end{matrix}\right\}$ then use $\left\{\begin{matrix}\dfrac{4a - 4 \times \frac{1}{2}u \times 2t}{\frac{1}{2}u \times 2t \times 2t - \frac{1}{2}u \times 2t} = r\\ \dfrac{8a - 8 \times \frac{1}{4}u \times 4t}{\frac{1}{4}u \times 4t \times 4t - \frac{1}{4}u \times 4t} = r\end{matrix}\right.$

IV. *Given, u, a, and r, to find t.*

RULE. $\dfrac{2}{r} - 1 = x$: then $\sqrt{\dfrac{2a}{u \times r} \times \dfrac{x \times x}{4}} - \dfrac{x}{2} = t.$

EXAMPLE.

21. If a pension of $250 per annum, being unpaid a certain time, amounts to $2065, at 6 per cent: What time has the payment been delayed? *Ans.* 7 *years.*

Note—If the payments are made $\left\{\begin{matrix}\text{half-yearly}\\ \text{quarterly}\end{matrix}\right\}$ then use $\left\{\begin{matrix}\frac{1}{2}r, \frac{1}{2}u, \text{ will give } 2t.\\ \frac{1}{4}r, \frac{1}{4}u, \text{ will give } 4t.\end{matrix}\right.$

PRESENT WORTH OF ANNUITIES.

Here p, represents the present worth; u, t, and r, as before.

I. *Given, u, t, and r, to find p.*—RULE. $\dfrac{t \times t \times r - t \times r + 2t}{2t \times r + 2} : \times u = p.$

EXAMPLE.

22. What is a pension of $250 per annum worth in ready money, at 6 per cent. for 7 years? *Ans.* $1454.225.

Note—Respecting half-yearly and quarterly the same as I.

II. *Given, p, t, and r, to find u.*

RULE. $\dfrac{t \times r + 1}{t \times t \times r - t \times r + 2t} : \times 2p = u.$

EXAMPLE.

23. What annuity is that which for 7 years continuance, at 6 per cent. produces $1454.225, present worth? *Ans.* $250.

Note—If the payments are made $\left\{\begin{matrix}\text{half-yearly}\\ \text{quarterly,}\end{matrix}\right\}$ then use $\left\{\begin{matrix}\frac{1}{2}r, 2t, \text{ and } \times \text{ by } 4p.\\ \frac{1}{4}r, 4t, \text{ and } \times \text{ by } 8p.\end{matrix}\right.$

III. *Given, u, p, and t, to find r.*—RULE. $\dfrac{u \times t - p \times 2}{2p \times t + u \times t - ut \times \times t} = r.$

EXAMPLE.

24. If an annuity of $250 per annum, to continue 7 years, produce $1454.225 for the present worth, what is the rate per cent? *Ans.* 6 per cent.

Note—If the payments are made $\left\{\begin{array}{l}\text{half-yearly}\\ \text{quarterly}\end{array}\right\}$ then use $\left\{\begin{array}{l}\frac{1}{2}u, 2t, \text{ will give } \frac{1}{2}r.\\ \frac{1}{4}u, 4t, \text{ will give } \frac{1}{4}r.\end{array}\right.$

IV. *Given, u, p, and r, to find t.*

RULE. $\frac{2}{r} - \frac{2p}{u} - 1 = x : \sqrt{\frac{2p}{u \times r} + \frac{x \times x}{4}} - \frac{x}{2} = t.$

EXAMPLE.

25. Required the time that \$250 per annum, may be purchased for \$1454.225 at 6 per cent. *Ans.* 7 *years.*

Note—If the payments are made $\left\{\begin{array}{l}\text{half-yearly}\\ \text{quarterly}\end{array}\right\}$ then use $\left\{\begin{array}{l}\frac{1}{2}u, \frac{1}{2}r, \text{ will give } 2t.\\ \frac{1}{4}u, \frac{1}{4}r, \text{ will give } 4t.\end{array}\right.$

ANNUITIES, &c. TAKEN IN REVERSION.

I. *To find the present worth of an annuity, &c. taken in reversion.*

RULE 1.—Find the present worth of the yearly sum at the given rate, and for the time of its continuance, Thus, $\frac{t \times t \times r - t \times r + 2t}{2t \times r + 2} : \times u = p.$

2. Change p into a, and find what principal being put to interest will amount to a, at the same rate, and for the time to come before the annuity, &c. commences, Thus, $\frac{a}{t \times r + 1} = p.$

EXAMPLE.

26. What is the present worth of 35*l.* per ann. to continue 12 years; but is not to commence till the end of 5 years, allowing 10 per cent. to the purchaser?

Ans. 197*l.* 5*s.* 5*d.* 1.792 *qr.*

II. *To find the yearly income of an annuity, &c. in reversion.*

RULE 1.—Find the amount of the present worth at the given rate, and for the time before the reversion, Thus, $p \times t \times r + p = a.$

2.—Change a into p, and find what annuity being sold will produce p, at the same rate, and for the time of its continuance, Thus, $\frac{t \times r + 1}{t \times t \times r - t \times r + 2t} : \times 2p = u.$

EXAMPLE.

27. A person having an annuity left him for 12 years, which does not commence till the end of 5 years, sold it for 197*l.* 5*s.* 5*d.* 1.792*qr.* allowing 10 per cent. to the purchaser: What was the yearly income? *Ans.* 35*l.*

REBATE OR DISCOUNT.

nts the sum to be discounted: p, the pres-
r, as before.

I. *Given, s, t, and r, to find p.*——RULE. $\frac{s}{t \times r + 1} = p.$

EXAMPLES.

28. What is the present worth of $600 due 3 years hence, at 5 per cent per annum? *Ans.* $508.4745.

29. What is the present worth of $357.50 to be paid 9 months hence, at 5 per cent per annum? *Ans.* $344.5783.

II. *Given, p, t, and r, to find s.*——RULE. $p \times t \times r + p = s.$

EXAMPLES.

30. If the present worth of a sum of money due 9 months hence, allowing 6 per cent, be $508.4745, what was the sum first due? *Ans.* $600.

31. A person paid $344.5783 for a debt due 9 months hence he being allowed 5 per cent for the discount, how much was the debt? *Ans.* $357.50.

III. *Given s, p, and t, to find r.*——RULE. $\frac{s-p}{t \times p} = r.$

EXAMPLES.

32. At what rate per cent, will $600 payable 3 years hence, produce $508.4745 for present payment? *Ans.* 6 *per cent.*

33. At what rate per cent, will $357½ payable 9 months hence, produce the present payment of $344.5783. Ans. 5 *per cent.*

IV. *Given s, p, and r, to find t.*——RULE. $\frac{s-p}{r \times p} = t.$

EXAMPLES.

34. The present worth of $600 due for a certain time to come, is $508.4745 at 6 per cent, in what time should the sum have peen paid without any rebate? *Ans.* 3 *years.*

35. I have received $344.5783 for a debt of $357½ allowing the person 5 per cent for prompt payment, I desire to know when the debt would have been payable without the discount? *Ans.* 9 *months.*

EQUATION OF PAYMENTS.

I. *To find the equated time for the payment of a sum of money due at several times.*

Rule 1—Find the present worth of each payment for its respective time } Thus, $\frac{s}{t \times r + 1} = p.$

2. Add all the present worths together, and call that sum p, then will $s - p = d$ the rebate.

3. And $\frac{d}{p \times r} = e$, the true equated time.

EXAMPLES.

36 M. owes N. $200, whereof $40 is to be paid at 3 months, $60 at 6 months, and $100 at 9 months; at what time may the whole debt be paid together, rebate being made at 5 per cent? *Ans.* .57315 *years*=6 *months*, 26 *days*.

37. P. owes Q. $800, whereof $200 is to be paid in 3 months $200 at 4 months, and $400 at 6 months: but they agreeing to make but one payment of the whole, at the rate of 5 per cent discount: the true equated time is demanded? *Ans.* 4 *months* 22 *days*.

38. R. owes S. $1200, which is to be paid as follows: $200 down, $500 at the end of 10 months, and the rest at the end of 20 months; but they agreeing to have one payment of the whole, rebate at 3 per cent; the true equated time is demanded? *Ans.* 1 *year* 11 *days*.

COMPOUND INTEREST.

Compound Interest is that which arises from a principal increased by its interest, as the interest becomes due.

The letters here made use of, are,

a, the amount.

p, the principal, hence, $a-p$, the interest.

t, the time.

r, the ratio, or amount of $1, or £. for 1 year at any given rate, which is thus found:

$$\text{As}\begin{cases}100 : 105 :: 1 : 1.05=r, \text{ at 5 per cent.}\\ 100 : 106 :: 1 : 1.06=r, \text{ at 6 per cent.}\\ 100 : 107 :: 1 : 1.07=r, \text{ at 7 per cent.}\end{cases}$$

I. *Given, p, t, and r, to find a.* RULE. $pXr^t=a$.

EXAMPLES.

1. What will $200 amount to in 4 years, at 5 per cent per annum? *Ans.* $243.10125.

2. What will $480 amount to in 5 years, at 6 per cent per annum? *Ans.* $642.348288.

II. *Given, a, r, and t, to find p.*——RULE. $\frac{a}{r^t}=p$.

EXAMPLES.

3. What principal being put to interest will amount to $243.10125 in 4 years, at 5 per cent? *Ans.* $200.

4. What principal being put to interest will amount to $642.348288 in 5 years at 6 per cent? *Ans.* $480.

III. *Given, p, a, and r, to find t.*——RULE. $\frac{a}{p}=r^t$ which [illegible]vided by r, till nothing remains, the num[illegible]s will be $=t$.

EXAMPLES.

5. In what time will $200 amount to $243.10125 at 5 per cent? *Ans.* 4 *years.*

6. In what time will $480 amount to $642.348288 at 6 per cent? *Ans.* 5 *years.*

IV. *Given, p, a, and t, to find r.—Rule.* $\frac{a}{p}=r^t$: then $\sqrt[t]{r^t}=r$.

EXAMPLES.

7. At what rate per cent will $200 amount to $243.10125 in 4 years? *Ans.* 5 *per cent.*

8. At what rate per cent will $480 amount to $642.348288 in 5 years? *Ans* 6 *per cent.*

ANNUITIES, OR PENSIONS, IN ARREARS.

Here u represents the annuity, pension, &c, a, r, t, as before.

I. *Given, u, t, and r, to find a.——Rule.* $\frac{uXr^t-u}{r-1}=a$.

EXAMPLES.

9. What will an annuity of $50 per annum, payable yearly, amount to in 4 years, at 5 per cent? *Ans.* $215.50625.

10. What will an annuity of $75 per annum, payable yearly, amount to in 6 years, at 6 per cent? *Ans.* $523.14885.

II. *Given, a, r, and t, to find u.—Rule.* $\frac{aXr-a}{r^t-1}=u$.

EXAMPLES.

11. What annuity being forborne 4 years, will amount to $215.50625 at 5 per cent? Ans. $50.

12. What salary being omitted to be paid 6 years, will amount to $523.14885 at 6 per cent? Ans. $75.

III. *Given u, a, and r, to find t.——Rule.* $\frac{aXr+u-a}{u}=r^t$

which being continually divided by r, till nothing remains, the number of those divisions will be $=t$

EXAMPLES.

13. In what time will $50 per annum amount to $215.50625 at 5 per cent? Ans. 4 years.

14. In what time will $75 per annum amount to $523.14885 allowing 6 per cent for forbearance of payment? Ans. 6 ye

PRESENT WORTH OF ANNUITIES, PENSION

I. *Given, u, t, and r, to find p.——Rule.* $u=\frac{u}{r^t-1}$

EXAMPLES.

15. What is the present worth of an annuity of $30 per annum, to continue 7 years at 6 per cent? Ans. $167.4716.

16. What is the present worth of a pension of $50 per annum, for 8 years. at 5 per cent? Ans. $323.1608.

II. *Given, p, t, and r, to find u.—Rule.* $\frac{pXr^tXr-pXr^t}{r^t-1}=u.$

EXAMPLES.

17. If an annuity be purchased for $167.4716 to be continued 7 years at 6 per oent: quere the annuity? Ans. $30.

18. If the present worth of $323.1608 were required for a pension for 8 years to come, at 5 per cent, what was the pension? Ans. $50.

III. *Given, u, p, and r, to find t.—Rule.* $\frac{u}{p+u-pXr}=r^t$

which being continually divided by r, till nothing remains, the number of those divisions will be $=t$.

EXAMPLES.

19. How long may a lease of $30 yearly rent be had for $167.4716 allowing 6 per cent to the purchaser? Ans. 7 years.

20. If a house is let upon lease for $50 per annum, and the lessee makes present payment of $323.1608, he being allowed 6 per cent: I demand how long the lease is purchased for? Ans. 8 years.

ANNUITIES, LEASES, &c. TAKEN IN REVERSION.

I. *To find the present worth of annuities, &c. in reversion.*

Rule 1—Find the present worth of the annuity, &c. at the given rate, and for the time of its continuance, } Thus, $u-\frac{u}{r^t}:\div r-1=p.$

2. Change p into a, and find what principal being put to interest will amount to p, at the same rate, and for the time to come, before the annuity commences, which will be the present worth of the annuity, &c. } Thus, $\frac{a}{r^t}=p.$

EXAMPLES.

21. What is the present worth of a reversion of a lease of $30 per annum, to continue for 7 years, but not to commence till the end of 4 years, allowing 5 per cent. to the purchaser? Ans. $142.9153.

's a lease of a house at $40 per annum, which for 2 years, and the lessee is desirous to take ion for 6 years, to begin when the old lease

shall be expired, what will be the present worth of the said lease in reversion, allowing 6 per cent. to the purchaser?
Ans. $175.0563.

II. *To find the yearly income of an annuity, &c. taken in reversion.*

Rule 1.—Find the amount of the present worth, at the given rate, and for the time before the annuity commences. } Thus, $pXr^t = a$.

2. Change a into p, and find what yearly rent, &c. being sold will produce p, at the same rate, and for the time of its continuance, } Thus, $\frac{pXr^tXr - pXr^t}{r^t - 1} = n$.

EXAMPLES.

23. What annuity to be entered upon 4 years hence, and then to continue 7 years, may be purchased for $142.9153 at 5 per cent. Ans. $30.

24. There is a lease of a house in being for 2 years, and the lessee being minded to take a lease in reversion for 5 years, to begin when the old lease shall be expired, paid down $175.0563: What was the yearly rent of the house, when the lessee was allowed 6 per cent. for present payment? Ans. $40.

REBATE OR DISCOUNT.

Here s represents the sum to be purchased, t, r, p, as before.

I. *Given, s, t, and r, to find p.* Rule. $\frac{s}{r^t} = p$.

EXAMPLE.

25. What is the present worth of $315.6175, payable 4 years hence, at 6 per cent? Ans. $250.

II. *Given, p, t, and r, to find s.*—Rule. $pXr^t = s$.

EXAMPLE.

26. If a sum of money due 4 years hence produce $250 for the present payment, rebate being made at 6 per cent. What was the sum first due? Ans. $315.6175.

III. *Given, s, p, and r, to find t.*—Rule. $\frac{s}{p} = r^t$ which being continually divided by r, till nothing remains, the number of those divisions will be $= t$.

EXAMPLE.

27. The present payment of $250 is made for $315.6175, rebate at 6 per cent. In what time is payable? Ans.

IV. *Given, s, p, and t, to find r.*—Rule. $\frac{s}{p}=r^t$: $\sqrt[t]{r^t}=r$.

EXAMPLE.

28. A debt of $315.6175 is due 4 years hence, but it is agreed to take $250 now. What is the rate per cent. that the rebate is made at? Ans. 6 *per cent.*

PURCHASING FREEHOLD OR REAL ESTATES,

Is to find the present worth of an annuity to continue forever.

I. *Given, u, and r, to find p.*—Rule. $\frac{u}{r-1}=p$.

EXAMPLES.

29. What is the worth of a freehold estate of $50 per ann. allowing 5 per cent. to the buyer? Ans. $1000.

30. If a freehold estate of $75 yearly rent was to be sold, what is it worth allowing the buyer 6 per cent? Ans. $1250.

II. *Given, p, and u, to find r.*——Rule. $\frac{p+u}{p}=r$.

EXAMPLES.

31. If an estate of $50 per annum be bought for $1000: what is the rate per cent? Ans. 5 per cent.

32. If a freehold estate of $75 per annum is sold for $1250 what is the rate per cent allowed? Ans. 6 per cent.

III. *Given, p, and r, to find u.*——Rule. $p\times\overline{r-1}=u$.

EXAMPLES.

33. If a freehold estate is bought for $1000, and the allowance of 5 per cent. is made to the buyer, what is the yearly rent? Ans. $50.

34. If a freehold estate is sold for $1250 present money, and an allowance of 6 per cent. made to the buyer for the same: Quere the yearly rent? Ans. $75.

PURCHASING FREEHOLD ESTATES IN REVERSION

I. *To find the worth of a freehold estate in reversion.*

Rule 1.—Find the worth of the yearly rent, } Thus, $\frac{u}{r-1}=p$.

2. Change p into a, and find what principal being put to interest will amount to a, at the same rate, and for the time to come, before the estate commences, } Thus, $\frac{a}{r^t}=p$.

EXAMPLES.

d estate of $50 per ann. to commence 4 be sold, what is it worth, allowing the t. for present payment? Ans. $822.70625

36. What is an estate of $240 per ann. worth in ready money, to continue for ever, but not to commence till the end of 3 years, allowance being made at 6 per cent?
Ans. 3358.477\frac{1}{3}$.

II. *To find the yearly rent of an estate taken in reversion.*

RULE 1—Find the amount of the worth of the estate at the given rate, and the time before it commences. Thus, $p \times r^t = a$.

2. Change a into p, and find what yearly rent being sold will produce p at the same rate. Thus, $\frac{\overline{p \times r \times r} - \overline{p \times r}}{r} = u$.

EXAMPLES.

37. If a freehold estate, to commence 4 years hence, is sold for $822.70625, allowing the purchaser 5 per cent. What is the yearly income? *Ans.* $50.

38. There is a freehold estate bought for 3358.477\frac{1}{3}$ but not to commence till the expiration of 3 years, allowing 6 per cent. for present payment: What is the yearly income?
Ans. $240.

INSURANCE.

Insurance is a security given by the underwriters, to indemnify the insured from such losses, as are mentioned in the policy of insurance, in consideration of a sum of money called premium; which varies according to the risk, and is generally at so much per cent.

In cases of total loss, the underwriter, is allowed a discount or rebate of 2 per cent.

Most of the computations relative to insurance, fall under one or other of the following cases, viz.

Let x, represent 100 dollars or pounds.

r, ——— the rate per cent. of the premium.
a, ——— the amount to be insured.
s, ——— the sum to be covered.
d, ——— the discount or rebate.
p, ——— the whole insurance or premium.

1. *Given, a, and r, to find p.*—RULE. $\frac{a \times r}{x} = p$

EXAMPLES.

1. What will be the whole insurance on $4500, from New-York to Bombay, at 6 per cent. *Ans.* $270.

2. What is the insurance on 5000*l.* from London to Hamburgh, at 1½ per cent? *Ans.* 75*l.*

Merchants sometimes cover their property by taking out policy *for such amount* as will be equal to the value of the *voice and premium* together.

II. *Given, s, and r, to find a.*—RULE. $\frac{x \times s}{x-r} = a$

EXAMPLES.

3. A merchant ships goods as per invoice, 4173*l.* 12 what amount of a policy will cover the same premium at per cent discount, 2 per cent in case of loss? *Ans.* 4440*l.*

4. Shipped goods for Constantinople valued at $7590 Premium 6 per cent. discount 2 per cent in case of loss: for what sum must the policy be taken? *Ans.* $8250.

III. *Given, a, r, and d, to find s.*—Rule. $\frac{x-r+d \times a}{x} = s.$

EXAMPLES.

5. If a policy be taken out for 4440*l.* at 4 per cent premium, and 2 per cent discount. Quere, the amount of the invoice to be covered? *Ans.* 4173*l.* 12*s.*

6. A trader insuring an adventure at 6 per cent premium, and 2 per cent discount in case of loss, took out a policy for $8250. Required the invoice amount? *Ans.* $7590.

IV. *Given, a and s, to find r+d.*—Rule. $\frac{a-s \times x}{a} = r+d.$

EXAMPLES.

7. Suppose a merchant to take out a policy for 4440*l.* to insure 4173*l.* 12*s.* and cover the premium and discount; which is now required? *Ans.* 4 *and* 2 *per cent.*

8. A trader insuring an adventure took out a policy for $8250, to cover $7590. Quere, the rate per cent of the premium and discount? *Ans.* 6 *and* 2 *per cent.*

V. *When a vessel, or an adventure in goods is continued several voyages, or from one port to another, at the same or different risks, to find the amount that will cover the whole all round.*

Here *n*, represents the number of risks, and is the exponent of any given power. *x, r, a, s, d, p,* as before.

RULE. $\frac{s \times x^n}{x-r \times x-r \times x-r, \&c.} = a =$ sum to be insured:—

Or in words, multiply the sum to be covered by 100, raised to that power denoted by the number of risks, for a dividend: then subtract each premium from 100, and multiply the remainders for a divisor, the quotient will be the amount of the [illegible] to cover the vessel or adventure the voyage round.

EXAMPLES.

[illegible]se a merchant in New-York insures a vessel t[illegible] [illegible]alue $5000, at 4 per cent. thence to a port in th[illegible] [illegible]s, at 5 per cent. and thence to Baltimore, whe[illegible]

the voyage ends, at 3 per cent: For what sum must he take out a policy to cover the whole round? *Ans.* $5652.01664.

10. A merchant in London insures 1011*l.* 18*s.* 8*d.* to Hamburgh at 2½ per cent. thence to Surinam at 7 per cent. thence to Liverpool at 5 per cent. and thence to Boston, where the voyage ceases, at 4 per cent. Required the amount that will cover this adventure all round, with 2 per cent in case of loss? *Ans.* 1250*l.*

VI. *When a sum is adventured from one port to another as in the last case, either at the same, or different risks, to find the rate per cent. of premium for the voyage round, tantemount to the several given rates per cent*

RULE. Find a by the last: then $\frac{\overline{a-s}\times x}{a}=r$.

EXAMPLE.

11. Take the amount of the 9 quest. 5652.01664=a$.
Sum adventured, 5000.00000=p$.
5652.01664) 6[illegible]×100.
Tantemount to all the risks, = 11.5[illegible] *per cent.*

VII. *If a policy be taken out for a given sum to cover a certain adventure from one port to another, or to several ports, at equal premiums for each risk, to find what that equal premium is.*

RULE. $x-\sqrt[n]{\frac{\overline{s\times x^n}}{a}}=r=$ the rate per cent of premium.

EXAMPLE.

12. A. in Alexandria, adventures $4805 to Leith; from thence to Jamaica; from thence home: to cover which he took out a policy for $5604.3125, and the premium was equal from one place to the other: What was the rate per cent of premium? *Ans.* 5 *per cent.*

VIII. *When a ship or an adventure is insured out and home at one risk, at a given rate per cent. and that the voyage terminates short of what was at first intended, to find what proportion the underwriters must receive per cent.*

RULE 1.—If half the voyage is performed, it must be considered as at two equal risks, if one third at three, if one fourth at four, &c. and by case II. find a=amount to be insured.

2. Find by case VII. what the underwriters must receive per cent.

EXAMPLE.

13. Admit that a merchant of Amsterdam covers 20000 guilders, at 6 per cent. to Bourdeaux and back again, but the voyage ending there: It is required to find what the insurer must receive per cent? *Ans.* 3 *guild.* 14.88 *pennings per cent.*

GENERAL AVERAGE.

Average signifies a mean proportion of loss between the owners of goods thrown overboard in a storm in order to preserve the remainder, with the ship and lives of the men.

Ships on their voyages are exposed to storms, and often saved from perishing by cutting some of the masts, &c. away, or by casting goods overboard to lighten them, this measure is therefore allowed, and is justified by law and custom, in cases of imminent danger.

However, to make these acts legal, the three following essential cases ought to concur.

1st. The ship must be in evident hazard of perishing with the cargo and crew.

2d. The resolution the commander takes on this melancholy occasion, should be in consequence of a consultation held with his officers and sailors.

3d. That the ship and cargo, or the part of them that are saved, has been in consequence of the means used, done with that sole view.

Hence, it must be concluded, that all the expence and sacrifices, which are so made to prevent a total loss of ship and cargo, ought to be equally borne, by the ship and her remaining cargo.

EXAMPLES.

1. A schooner from Charleston, bound to New-York, lost her masts by stress of weather, in consequence of which, the master and crew were under the necessity to run her ashore on Cape Charles in order to preserve their lives and the cargo, the expence and damage sustained on this occasion was $525.

Form of average account.

A's goods - - - - - -	$2400	If 7500 : 525 : : 1 : .07 then
B's goods - - - - - -	960	[Com.
Insured by N. Y. Ins. Com.	3360	3360×.07=235.50=loss to In.
A's own risk - - - - - -	600	600×.07= 42.00=loss to A.
B's own risk - - - - - -	540	540×.07= 37.80=loss to B.
Value of the goods - -	4500	
Value of the schooner -	2250	2250×.07=157.50=loss to sc.
Amount of freight - - -	750	750×.07= 52.50=loss to fr.
	7500	Proof, 525.00

2. The ship Maria Adelaide, from London to Philadelphia, [illegible] ich a storm at sea, that the officers and men [illegible] le to save her without throwing part of the [illegible] which they did as follows, viz. 20 chests mark- [illegible], containing muskets; 25 casks, marked A W. [illegible] ining shot; and 14 trunks, marked SB. No. 1

to 14, containing books, &c. thus lightening her and the storm abating they after a few weeks arrived at the destined port, where an average bill was made in order to adjust the loss, and was stated thus:

Average accruing to the ship Maria Adelaide, from London to Philadelphia, for goods thrown overboard for the preservation of the ship, freight, remainder of the cargo, and lives of the crew.

T. S. No. 1 to 100. 100 chests, containing 6000 muskets, at $3 per musket.		$18000 0 0
A. W. No. 1 to 25. containing 25 tons of shot at $140 per ton.		3500 0 0
S. B. No. 1 to 14 containing books, &c. amounting to		4362
J. A. No. 1 to 86. 86 packages dry goods amounting to		27506
W. M. No. 1 to 51. 51 trunks of sundries amounting to		14150
B. R. & Co. No. 1 to 107. 107 packages of sundries amounting to		19837
Freight on goods	4610	
Wages for all hands three months $498	815	
Provisions for ditto 317		3795
Ship Maria Adelaide valued at		13050
The value of all the property concerned		104200

T. S. part of his goods thrown overboard valued at	$3600
A. W. his goods thrown overboard valued at	3500
S. B. his ditto	4362
The whole amount of loss	11462

What is the average per cent, and what proportion of the loss must each sustain?

Ans.

Average	11 per cent.	
T. S. his remainder of goods must pay		$1584.00
J. A. his amount of goods must pay		3025.66
W. M.	ditto	1556.50
B. R. & Co.	ditto	2182.07
Freight must pay		417.45
Ship must pay		1435.50
Underwriters (if insured) must pay		1260.82
	proof	11462.00

3. The ship Hero, laden with tobacco from City-Point in the River James bound to Hamburgh, ran ashore on the of Newfoundland. The master after expending

lighters and laborer's hire, got again to sea and finally arrived safe at Hamburgh, where he entered a protest, after which and other necessary arrangements, an average account was thus stated.

Average accrued to ship Hero from City-Point to Hamburgh, for lighters and men to get her off the banks of Newfoundland.

Paid sundry charges at Placentia for lighters and men to assist in getting off the ship.	$512	
Protest and other charges	21½	
The whole loss is	533½	= m. b. 1600
280 hhds. tobacco, valued at		m. b. 120000
Freight on do. at 63*s.* ster. per hhd. exchange on Lon. 35⅞*s.* flem. per £. ster.	11760	
Wages and provisions for the crew amounting to $720 exchange at 33⅓	2160	
		9600
Ship Hero valued at		30400
Value of all the property concerned		160000

I demand the rate per cent of average, and the proportion of loss to be paid by each species of property?

Ans.	Average	1 per cent.
	Cargo must pay	m. b. 1200
	Freight ditto	96
	Ship ditto	304
		proof 1600

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PART V.

DUODECIMALS, OR, CROSS MULTIPLICATION.

Cross multiplication is a rule made use of by workmen and artificers in computing the contents of their work.

Dimensions are generally taken in feet, inches, and parts. Inches and parts are sometimes called primes, seconds, thirds, &c. and are marked thus: inches or primes (′), seconds (″), thirds (‴), fourths (⁗), &c.

RULE—Feet multiplied by feet, produce feet.
Feet multiplied by inches, produce inches.
Feet multiplied by seconds, produce seconds,
Inches multiplied by inches, produce seconds.
Inches multiplied by seconds, produce thirds.
Seconds multiplied by seconds, produce fourths, &c.

EXAMPLES.

1. Let 7 feet 5 inches 9 parts be multiplied by 3 feet 5 inches 3 parts.

ft.	*in*			
7	5	9″		
3	5	3		
22	5	3		
3	1	4	9‴	
	1	10	5	3⁗
25	8	6	2	3

2. Multiply 97 feet 8 inches by 8 feet 9 inches.
Ans. 854 *feet 7 inches.*

3. Let 8 feet 4 inches 3 parts or seconds 5 thirds 6 fourths be multiplied by 3 feet 3 inches 7 seconds 8 thirds 2 fourths.
Ans. 27 *ft.* 7 *in.* 3-2*ds.* 5-3*ds.* 1-4*th.* 8-5*ths.* 8-6*ths.* 11-7*ths.*

4. Multiply 321 feet 7 inches 3 parts, by 9 feet 3 inches 6 parts. *Ans.* 2988 *ft.* 2 *in.* 10 *sec.* 4 *thirds* 6 *fourths.*

5. Multiply 124 feet 7 inches 9 parts, by 14 feet 6 inches 2 parts. *Ans.* 1809 *ft.* 1 *in.* 1 *sec.* 9 *thirds* 6 *fourths.*

SUPERFICES.

1. *To find the area of a parallelogram; whether it be a rectangle, a rhombus, or a rhomboides.*

RULE—Multiply the length by the perpendicular and the product will be the area.

EXAMPLES.

6. Required the area of a square whose side is 5 feet 9 inches? *Ans.* 33 *ft.* 0 *in.* 9″.

7. Required the area of a rectangle, whose sides are 56 feet, and 18 feet 6 inches? *Ans.* 1036 *feet.*

8. Required the area of the rhombus or rhomboides, whose length is 12 feet 6 inches, and its height 9 feet 3 inches? *Ans.* 115 *ft.* 7 *in.* 6″.

II. *To find the area of a triangle.*

RULE—Multiply the base by the perpendicular height, and half the product will be the area.

EXAMPLES.

9. Required the area of the triangle whose base is 10 feet 9 inches, and height 7 feet 3 inches. *Ans.* 38 *ft.* 11 *in.* 7½″.

10. What is the area of a triangle, whose base is 18 feet 4 inches, and height 11 feet 10 inches? *Ans.* 108 *ft.* 5 *in.* 8′.

III. *To find the area of a trapezium.*

RULE—Multiply the diagonal by the sum of the two perpendiculars falling upon it from the opposite angles, and half the product will be the area.

EXAMPLES.

11. What is the area of a trapezium whose diagonal is 108 feet 6 inches, and the perpendiculars 56 feet 3 inches, and 60 feet 9 inches? *Ans.* 6347 *feet,* 3 *inches.*

12. Required the area of a trapezium whose diagonal is 60 feet, and the perpendiculars 50 feet and 40 feet? *Ans.* 2700 *feet.*

IV. *To find the area of a trapezoid, or quadrangle, two of whose opposite sides are parallel.*

RULE—Multiply the sum of the parallel sides by the perpendicular distance between them, and half the product will be the area.

EXAMPLES.

13. Required the area of a trapezoid whose parallel sides are 25 feet 6 inches, and 18 feet 9 inches, and the perpendicular distance 10 feet, 5 inches. *Ans.* 230 *ft.* 5 *in.* 7″.

14. How many square feet are in a plank 13 inches broad at one end, and 15 at the other, the length being 16 feet 5 inches? *Ans.* 19 *feet,* 1 *inch,* 10″.

OF THE CIRCLE.

I. *The diameter of a circle being given to find the circumference; or, the circumference being given to find the diameter.*

RULE.

7 : 22 : : so is the diameter : to the circumference ;
or, 113 : 355 : : so is the diameter : to the circumference.
22 : 7 : : so is the circumference : to the diameter.
or, 355 : 113 : : so is the circumference : to the diameter.

EXAMPLES.

1. The diameter of a circle is 9 feet: What is the circumference? *Ans.* 28.27 *feet.*

2. If the diameter of a circle be 10 feet: What is the circumference? *Ans.* 31.41 *feet.*

3. If the circumference of a circle be 354, what is the diameter? *Ans.* 112.681.

4. The circumference of the globe is known to be 25000 miles: Required its diameter? *Ans.* 7958 *nearly.*

II. *To find the area of a circle.*

RULE—Multiply half the circumference by half the diameter, and the product will be the area.

EXAMPLES.

5. What is the area of a circle whose diameter is 42, and circumference 131.946? *Ans.* 1385.433.

6. What is the area of a circle whose diameter is 10 feet 6 inches, and circumference 31 feet 6 inches? *Ans.* 82 *ft.* 8 *in.*

SOLIDS.

I. *To find the solidity of a cube.*

RULE—Multiply the side of the cube by itself, and that product again by the side, and it will give the solidity.

EXAMPLES.

1. Required the solidity of a cube whose sides are 15 inches? *Ans.* 1 *ft.* 11 *in.* 5″.

2. The side of a cube is 25 feet 6 inches: required the solidity? *Ans.* 16581 *ft.* 4½ *in.*

II. *To find the solidity of a parallelopipedon.*

RULE—Multiply the length by the breadth, and that product again by the depth, or heighth, and it will give the solidity.

EXAMPLES.

3. Required the solidity of the parallelopipedon, whose length is 8 feet, breadth 4½ feet, and depth 6¾ feet? *Ans.* 243 ft.

4. What is the solid content of a block of marble, whose length is 10 feet, its breadth $5\frac{3}{4}$ feet, and the depth $3\frac{1}{2}$ feet? *Ans.* $201\frac{1}{4}$ *ft.*

III. *To find the solidity of a triangular prism.*

RULE—Multiply the area of the base into the perpendicular height, and the product will be the solidity.

EXAMPLES.

5. Required the solidity of the triangular prism whose length is 10 feet, and either of the equal sides of one of its equilateral ends $2\frac{1}{2}$ feet? *Ans.* 27.063 *ft.*

6. Required the solidity of a prism whose length is 18 feet, and one side of the equilateral end $1\frac{1}{2}$ feet? *Ans.* 17.50859 *ft.*

IV. *To find the solidity of a cylinder.*

RULE—Multiply the area of the base by the perpendicular height, and the product will be the solidity.

EXAMPLES.

7. What is the solidity of the cylinder, the diameter of whose base is 30 inches, and the height 50 inches? *Ans.* 20.4531 *ft.*

8. What is the solidity of the cylinder whose height is 20 feet, and the circumference of its base 20 feet also? *Ans.* 636.64

V. *To find the solidity of a pyramid or cone.*

RULE—Multiply the area of the base by $\frac{1}{3}$, the perpendicular altitude, and the product will be the solidity.

EXAMPLES.

9. Required the solidity of a square pyramid, each side of whose base is 30, and the perpendicular height 20? *Ans.* 6000.

10. What is the solidity of a cone, the diameter of whose base is 18 inches, and its altitude 15 feet? *Ans.* 8.83575 *ft.*

11. If the circumference of the base of a cone be 40 feet, and the height 50 feet: What is the solidity? *Ans.* 2120 *ft.*

VI. *To find the solidity of the frustum of a pyramid or cone.*

RULE—Add into one sum the area of both ends, and the mean proportional between them; multiply the sum by $\frac{1}{3}$ the perpendicular height, and the product will be the solidity.

EXAMPLES.

12. What is the solidity of the frustum of a square pyramid, one side of the greater end being 18 inches, that of the lesser end 15 inches, and the height 60 inches? *Ans.* 16380 inches.

13. What is the solidity of the frustum of the cone, the diameter of the greater end being 4 feet, that of the lesser end 2 feet, and the altitude 9 feet? *Ans.* 65.9736.

14. What is the solidity of the frustum of a cone, the circumference of the greater end being 40, that of the lesser end 20, and the length or height 50? *Ans.* 3713.64.

VII. *To find the solidity of a sphere or globe.*

RULE—Multiply the cube of the diameter by .5236, and the product will be the solidity.

EXAMPLES.

15. Required the solidity of a sphere of 10 inches diameter. *Ans.* 523.6.

16. How many solid miles are in the terraqueous globe, its diameter being 7958 miles? *Ans.* 263883017937.1232.

ARTIFICERS WORK.

I. *Glaziers & Masons flat work is measured by the square foot.*

EXAMPLES.

1. What is the content of 12 windows, each measuring 3 feet 10 inches long, and 2 feet 8 inches broad: what will the glazing come to at 25 cents per foot? *Ans.* $25⅔

2. There is a house with 3 tier of windows, 4 in a tier, the height of the first tier is 6 feet 6 inches, the second 5 feet 3 inches, and the third 4 feet 9 inches, the breadth of each window is 3 feet 9 inches: what will the glazing come to at 2*s.* 8*d.* per foot? *Ans.* 33*l.*

3. What is the price of a marble slab whose length is 6½ feet, and breadth 3¼ feet, at $1 per foot? *Ans.* $21.12½

II. *Painting, Plaistering, Paving, &c. is measured by the yard square.*

RULE—Divide the square feet by 9 the quotient will be the number of square yards.

EXAMPLES.

4. What will the paving of a street come to at 12½ cents per yard, the length of the street being 176½ feet, and the breadth 56¼ feet? *Ans.* $139.116.

5. What is the content of a piece of wainscotting in square yards, that is 9 feet 6 inches in height, and 8 feet 3 inches broad, and what will it come to at 12*s.* per yard.

Ans. 8*ft.* 6′. 4″. 6‴ and 5*l.* 4*s.* 6*d.*

6. There is a room 84 feet round, and 9 feet 6 inches high, in which are three windows, each 6 feet high and 3 feet 5 inches wide, and the fire-place 4 feet by 4 feet: I demand how many yards of paper, half yard wide will hang it?

Ans. 160 *yds.* 6 *in.*

7. *What will the plaistering of a ceiling, at 21d. ⅟ yard come to, supposing the length 34½ feet, and the brea 20 feet?* *Ans.* 6*l.* 14*s.* 2*d*

III. *Flooring, Partitioning, Roofing, Tiling, &c. is measured by the square of 100 feet.*

RULE—Divide the area in square feet by 100, the quotient will be the number of squares.

EXAMPLES.

8. In 120 feet 6 inches in length, and 12 feet 9 inches in height of partitioning, how many squares?
Ans. 15 *sq.* 36 *ft.* 4 *in.* 6″.

9. What difference is there between a floor 28 feet long by 20 broad, and two others that measure 14 feet a piece by 10; and what do all three come to at £11¼ per square?
Ans. 280 *ft. diff. and* £94.50.

10. How many planks will floor a room 60¾ feet long, and 33½ wide, supposing the plank 15 feet long, and 15 inches wide? *Ans.* 108$\frac{7}{18}$ *nearly.*

11. Suppose a house measures, within the walls, 64 feet in length, and 36 feet in breadth, and to be a true pitch, what will it come to roofing at 25*s.* the square? *Ans.* 43*l.* 4*s.*

IV. *Bricklayer's Work is measured by the rod, of 272¼ square feet.*

This work is always computed at the rate of a brick and a half thick, and if the thickness of the wall is more or less, it must be reduced to that thickness, by the following

RULE 1—Multiply the area of the wall in feet, by the number of half bricks in the thickness; divide the product by 816¼, and the quotient will be the rods: or,

2 Multiply the area of the wall by the half bricks in the thickness of the wall; the product divided by 3, gives the area in feet, which divide by 272¼, the quotient will be the rods required.

Note.—The fraction ⅔ in rule 1, or ⅓ in rule 2, commonly rejected in practise.

EXAMPLES.

12 How many square rods are there in a wall 52¾ feet long, 12 feet 9 inches high, 2½ bricks thick. *Ans.* 4*r.* 27*ft.* 7*in.*

13 A gentleman built a wall round his garden, which is 84[illegible] feet, and 9 feet high, and 2½ brick thick: how many rods doth it contain and what will it come to at £30 per rod?
Ans. 45 r. 88 ft. and £1359 7s 1d.

14. If each side wall of a building be 45 feet long on the [illegible] side, each end wall 15 feet broad on the inside, the height [illegible] feet and the gable at each end [illegible] the wall [illegible] bricks thick, required the [illegible] rods? *Ans.* [illegible]

[illegible] of a house [illegible] feet breadth, and 4[illegible] the roof; ½ of which is 2 bricks thick, ½ [illegible] 1 brick thick [illegible] the same rods?

course of bricks, (4 of which usually make a foot in depth) and this is but 4 inches, or half a brick thick; what will this piece of work come to at $32 per statute rod?

Ans. $119.8576.

TO CALCULATE FREIGHT ON PACKAGES OF MERCHANDIZE.

RULE—Find the cubic feet as in case II. of Solids, which divide by 40 for tons, then the amount of freight may be found by the Rule of Three, or Practice.

EXAMPLES.

1. What is the freight of a bale that is 7 feet 9 inches in length, 6 feet in breadth, and 3 feet 6 inches thick, at 20 cents per cubic foot? *Ans.* $32.55.

2. Required the freight at 18*d.* per cubic foot on a trunk that is 3 feet 6 inches in length, 2 feet 2 inches in breadth, and 1 foot 8 inches in depth. *Ans.* 18*s.* 10½.

3. I demand the freight of that case whose length is 7 feet 6 inches, breadth 5 feet 9 inches, and depth 5 feet, at $14 per ton? *Ans.* $75.46875.

TO FIND THE BURTHEN OF SHIPS.

RULE—Multiply the length of the keel in feet, by the breadth of the mid-ship-beam in feet, and that product again multiplied by the depth of the hold also in feet, which last product divide by 95 for merchants ships, and by 100 for ships of war, and the quotient is the tons.

EXAMPLES.

1. If the keel of a ship be 95 feet in length, and the breadth of the mid-ship-beam 32, and the depth of the hold 16 feet: What is the burthen?

Ans. { 512 tons as a merchants ship.
{ 486.4 tons as a ship of war.

2. The proportions of Noah's Ark were as follows, viz: 300 cubit the length of the keel, 50 feet the breadth of the mid-ship-beam, and 30 feet the depth of the hold: Required its burthen allowing the cubit as it is found by modern travellers, to be 22 inches?

Ans. { $29188\frac{24}{17}$ tons as a merchant ship.
{ $27729\frac{1}{6}$ tons as a ship of war.

GAUGING.

I. *To gauge any vessel, or to find what quantity of liquor it can contain.*

RULE.—Find how many solid inches will fill the cavity of the vessel, and divide these by the number of solid inches contained in any given measure, and the quotient is the content in that measure.

Table of cubic inches in several measures.

282	cubic inches	=	1 ale gallon.
231	ditto,	=	1 wine gallon.
268.8	ditto,	=	1 corn gallon.
2150.42	ditto,	=	1 corn or malt bushel.

II. *To find multipliers and gauge points for right lined surfaces.*

RULE—Divide 1 by the cubic inches in each measure, and the quotient will be equivalent multipliers, and their square roots, will be the gauge points.

EXAMPLE 1.

	divisors.	*multipliers.*		*gauge points.*
A. G.	282)1.000	(.003546 A.G.	✓	282=16.79 A. G.
W.G.	231)1.000	(.004329 W.G.	✓	231=15.19 W. G.
C.G.	268.8)1.000	(.00372 C. G.	✓	268.8=16.39 C. G.
M.B.	2150.42)1.000	(.000465 M. B.	✓	2150.42=46.37 M. B.

III. *To find the area of any rectangular tun, back, or cooler, &c. in ale and wine gallons, &c.*

RULE—Multiply the length by the breadth) both being in inches,) and divide the product by the divisors, or multiply it by the multipliers, the result will be the area in the measure required.

EXAMPLES.

2. Required the area of a square cooler whose side is 124½ inches, in ale and wine gallons, &c.

124.5×124.5=15500.25

by Division.	by Multiplication.
282)15500.25(54.96 A. G.	15500.25×.003546=54.96 A.G.
231)15500.25(67.10 W.G.	15500.25×.004329=67.10 W.G.
2150.42)15500.25(7.208 M. B.	15500.25×.000465=7.208 M.B.

By the Sliding Rule.

Set the divisor upon B. to the side of the square on A. against the side of the square on B. you have the area on A.

[illegible] gallons, &c.

[illegible]ck, &c. be a rectangular oblong, set the pro-[illegible] to the breadth on A. then against the length [illegible] on A.

[illegible]ultiplied by the depth, produce the content.

[illegible] the form of a rectangle 235 inches in length

and 68 inches in breadth: Required its area in ale and wine gallons, &c.

Ans. 56.66 A. G. 69.17 W. G. 59.44 C. G. and 7.43 M. B.

IV. *To find divisors, multipliers, and gauge-points for circular areas.*

RULE—Divide the cubic inches in measures by .785398 or .7854 (the area of a circle whose diameter is 1) the quotients will be divisors, and divide .785398 or .7854 by the cubic inches in measures, will quote multipliers.

The square roots of those divisors will give gauge-points.

EXAMPLE 4.

Divisors.	*Multipliers.*	*Gauge-points.*
359.05 A. G.	.002785 A. G.	18.95 A. G.
294.12 W.G.	.0034 W. G.	17.15 W. G.
342.24 C. G.	.00292 C. G.	18.5 C. G.
2738 M. B.	.000365 M. B.	52.32 M. B.

V. *To find the area of a circle in ale and wine gallons, &c.*

RULE—Divide the square of the diameter by the divisors, or multiply the same square by the multipliers, the result will be the area in ale and wine gallons, &c.

EXAMPLE.

5. Required the area of a circle whose diameter is 80 inches, in ale and wine gallons, &c.

Ans. { 17.82 A. G. 21.76 W. G. 2.338 M. B. by division.
17.79 A. G. 21.76 W. G. 2.356 M. B. by multiplication.

By the Sliding Rule.

Set the divisor on B. to the diameter on A. and against the diameter on B. is the area on A.

VI. *To find the content of any cube, parallelopiped, prism, or cylinder, in ale and wine gallons, &c.*

RULE 1—Find the area of the base in ale and wine gallons, &c. and multiply by the depth produces the content, or

2. Find the solidity in inches as taught in Solids, this content, divided by the divisors, or multiplied by the multipliers, will give the content in ale and wine gallons, &c.

EXAMPLES.

6. How many ale, wine gallons, and malt bushels will a vessel in the form of a parallelopipedon contain, the length being 72, the breadth and depth 82 inches?

Ans. { 690.89 A.G. 843.42 W.G. 90.60 M.B. by the 1st rule divis.
690.89 A.G. 843.42 W.G. 90.60 M.B by division. } 2nd.
790.87 A.G. 843.42 W.G. 90.59 M.B. by multipli. } rule.

BY THE SLIDING RULE.

Set 32 on G. to { 16.79 / 15.19 / 46.37 } on D, & against 48.74 the mean proportional between 72 & 33 on D. you will find the content on C. { 690.89 A. G. / 843.42 W.G. / 90.6 M. B. }

7. A cylinder, whose diameter is 72 inches, and depth 48, it is required to find the contents in ale and wine gallons?
Ans. 693 A. G. 846 W. G.

BY THE SLIDING RULE.

Set 48 on C. to $\left\{\begin{matrix}18.95\\17.15\end{matrix}\right\}$ on D, and against 72 on D. is the content on C. $\left\}\begin{matrix}693\text{ A. G.}\\846\text{ W.G.}\end{matrix}\right.$

VII. *To find the content of a pyramid, cone or their frustums in ale and wine gallons, &c.*

RULE—Compute the solidity in inches by the rules given in solids, which divided by the divisors, or multiplied by the multipliers, the result will give the gallons or bushels required.

EXAMPLES.

8. Suppose the side of the base of a square pyramid be 35 inches, and the altitude 57, required its contents in ale and wine gallons? Ans. 82.53 A. G. 100.75 W. G. 10.82 M. B.

BY THE SLIDING RULE.

Set $\frac{57}{3}$ on C. to $\left\{\begin{matrix}16.79\\15.19\\46.37\end{matrix}\right\}$ on the line D, and against 35 on D, is the content on C. $\left\}\begin{matrix}82.53\text{ A. G.}\\100.75\text{ W. G.}\\10.82\text{ M. B.}\end{matrix}\right.$

9. Required the content in ale and wine gallons and malt bushels of a conical vessel whose base diameter is 40 inches and altitude 60? Ans. 89.12 A. G. 108.8 W. G. 11.68 M. B.

BY THE SLIDING RULE.

Set $\frac{60}{3}$ on C. to $\left\{\begin{matrix}18.95\\17.15\\51.32\end{matrix}\right\}$ on D. then against 40 (the diameter of the base) on D. the con. are found on C $\left\}\begin{matrix}89.12\text{ A. G.}\\108.8\text{ W.G.}\\11.68\text{ M. B.}\end{matrix}\right.$

10. Required the content in ale, wine gallons and malt bushels of a vessel, whose bases are rectangles, the greater 90 by 60 inches, and the lesser 69 by 46, and depth 40 inches?
Ans. $\left\{\begin{matrix}601.13\text{ A. G. }733.85\text{ W. G. }78.82\text{ M. B. by division.}\\601.11\text{ A. G. }733.85\text{ W. G. }78.82\text{ M. B. by multiplication}\end{matrix}\right.$

11. Required the content of the lower frustum of a cone, the diameter of the greater base being 32 inches, that of the lesser 24, and depth 20 in ale and wine gallons?
Ans. 43.96 A. G. 53.67 W. G.

VIII. *The divisors for ale and wine gallons, &c. for a cylinder being given, to find divisors for any of the following solids; namely, the globe* $=\frac{2}{3}$, *spheroid* $=\frac{2}{3}$, *parabolic conoid* $\frac{1}{2}$, *hyperbolic conoid* $\frac{5}{12}$, *parabolic spindle* $=\frac{8}{15}$, *and cone* $=\frac{1}{3}$ *of the circumscribing cylinder.*

RULE—Observe what part each is of the circumscribing cylinder; then say,

As the numerator : is to the denominator : : so is the ale, and malt divisors of a cylinder : to the like divisors for required figures.

EXAMPLES.

12. Required ale, wine, and malt divisors for the cone, those of the cylinders being 359.05 for ale, 294.12 for wine, and 2738 for malt? Ans. 1077.15 ale div. 882.36 wine div. 8214 malt divisor. And so on for any other.

13. A cone whose diameter is 40 inches, and altitude 60, required its content in ale and wine gallons, &c.

$$40 \times 40 \times 60 = 96000$$

1077.15)96000(89.1 ale gallons.
882.36)96000(108.8 wine gallons.
8214)96000(11.68 malt bushels.

Multipliers to produce the same answers may be found as in problem II. and IV.

What is here shewn of the cone is sufficient to inform the student how to proceed with the other solids mentioned in the problem.

QUESTIONS FOR EXERCISE.

14. How many ale, wine gallons, and malt bushels will a vessel in the form of a spheroid, contain whose fixed axis is 100, and revolving 60 inches?

Ans. 668.4 A. G. 816.4 W. G. and 87.6 malt bushels.

15. Required the content of a parabolic conoid in ale and wine gallons, the height being 30, and diameter of its base 20 inches? Ans. 16.7 A. G. and 20.4 wine gallons.

16. Required the content of the hyperbolic conoid, the base being 100, and altitude 60 inches?

Ans. 696.2 ale, and 850 wine gallons.

17. Required the content of a parabolic spindle, whose length is 60, and greatest diameter 64 inches, in ale and wine gallons? Ans. 103.02 ale gallons, and 125.7 wine gallons.

CASK-GAUGING.

Cask are distinguished into the following four varieties:

1st. The middle frustum of a spheroid.
2nd. The middle frustum of a parabolic spindle.
3rd. The middle frustums of two parabolic conoids.
4th. The middle frustums of two cones.

IX. *To find the content of a cask.*

RULE 1—If the staves are very much curved, the cask is of the first variety, then to the square of the head diameter, add twice the square of the bung diameter, multiply the sum by the length, and divide the product by 1077.15 for ale, and by 882.36 for wine gallon.

2. If the staves are less curved than was supposed in the last, the cask is taken for the second variety: then to 9 times the square of the bung diameter, add 6 times the square of

the head diameter, multiply $\frac{1}{6}$ the sum by the length, divide as above for ale and wine gallons.

3. When the staves are very little curved, the cask is considered to be of the third variety; then to the sum and half sum of the squares of the head and bung diameters, add $\frac{1}{16}$ of the difference of their squares, multiply the sum by the length and divide as above for ale and wine gallons.

4. When the staves are straight between the bung and ends of the cask it is of the fourth variety; then from the sum and half sum of the squares of the head and bung diameters, subtract half the square of their difference; then multiply the remainder by the length, and divide as above for ale and wine gallons.

A general rule for reducing casks to a cylinder.

First, consider which of the varieties the proposed cask resembles, then from the bung diameter subtract the head diameter, and multiply by .7 for the spheroid, by .65 for the spindle, by .6 for the conoids, and by .55 for the cones; add the product to the head diameter, the sum is a mean diameter, or the diameter of a cylinder of equal content and length with the cask.

EXAMPLE.

18. Suppose the bung diameter be 32 inches, the head diameter 24, and the length of the cask 40 inches, the contents in ale and wine gallons, for each variety is required?

Ans. for the spheriod	97.44 ale gallons.	by the first rule.
	118.95 wine gallons.	
	97.4 ale gallons.	by the general rule.
	119.15 wine gallons.	
Ans. for the spindle	94.11 ale gallons.	by the second rule.
	114.89 wine gallons.	
	94.98 ale gallons.	by the general rule.
	115.95 wine gallons.	
Ans. for the conoids.	90.71 ale gallons.	by the third rule.
	110.83 wine gallons.	
	92.4 ale gallons	by the general rule.
	112.8 wine gallons.	
Ans. For the cones.	87.93 ale gallons,	by the third rule.
	107.34 wine gallons,	
	89.85 ale gallons,	by the general rule.
	109.69 wine gallons,	

By the Sliding Rule.

Set the length of the cask in inches on the line C. to the gauge-points (for circular areas) on D. and against the mean diameter, for each form or variety on the line D. you have the contents on C.

Diagonal Rod.

X. *The diagonal rod is generally used by those who are unacquainted with the rules of gauging, but when it so happens that no rod is at hand, then it must be done by the following*

RULE—With any straight rod, take the diagonal of the cask from the centre of the bung hole both ways, and make a mark on the rod, which may be measured with a carpenters rule, then multiply the cube of the diagonal in inches, by .002228 for ale, and by .00272 for wine gallons.

EXAMPLE.

19. Suppose a cask to measure diagonally 36 inches: Required the contents in ale and wine gallons.

Ans. $\begin{cases} 36\times36\times36\times.002228=103.949568 \text{ Ale Gallons.} \\ 36\times36\times36\times\ .00272=\ 126.90432 \text{ Wine Gallons.} \end{cases}$

A TABLE

Of the Segments of a Circle, whose Area is Unity.

V. S.	Segm	V. S.	Segm	V. S.	Segm	V. S.	Segm
1	.0017	99	.9983	26	.2066	74	.7924
2	.0048	98	.9952	27	.2178	73	.7832
3	.0087	97	.9913	28	.2292	72	.7708
4	.0134	96	.9866	29	.2407	71	.7593
5	.0187	95	.9813	30	.2523	70	.7477
6	.0245	94	.9755	31	.2640	69	.7360
7	.0308	93	.9692	32	.2759	68	.7241
8	.0375	92	.9625	33	.2878	67	.7122
9	.0446	91	.9554	34	.2998	66	.7002
10	.0520	90	.9480	35	.3119	65	.6881
11	.0598	89	.9402	36	.3241	64	.6759
12	.0680	88	.9320	37	.3364	63	.6636
13	.0764	87	.9236	38	.3487	62	.6513
14	.0851	86	.9149	39	.3611	61	.6389
15	.0941	85	.9059	40	.3735	60	.6265
16	.1033	84	.8967	41	.3860	59	.6140
17	.1127	83	.8873	42	.3986	58	.6014
18	.1224	82	.8776	43	.4112	57	.5888
19	.1323	81	.8677	44	.4238	[illegible]	.5762
20	.1424	80	.8576	45	.4364	55	.5636
21	.1526	79	.8474	46	.4491	54	.5509
22	.1631	78	.8369	47	.4618	53	
23	.1737	77	.8263	48	.4745	[illegible]	
24	.1845	76	.8155	49	.4873	[illegible]	
25	.1955	75	.8045	50	.5000		

XI. *To find the Ullage of a Cask.*

RULE 1—Find such a mean diameter as you judge, will reduce the proposed cask to a cylinder, and then find its content.

2. From the bung diameter subtract the mean diameter, and take half the difference.

3. From the wet inches subtract the said half-difference; reserve this difference, then use the proportion:

As the mean diameter is to 100
(the diameter of the tabular circle,)
So is the reserv'd difference,
to a versed sine in the table.

Then, if the tabular Segment be multiplied into the content (as before) the product will be the quantity of liquor in the cask.

EXAMPLE.

20. Let the cask be the same as in page 162, of the first form, where the bung-diameter is 32 inches, and the mean diameter 29.6, and the content 97.4 gallons: and suppose the wet inches 19, to find the quantity of liquor in the cask?

From	32	From	19
Subtr.	29 6	Subtr.	1.2
Rem.	1.4	Rem.	17.8 reserved.
Half	1.2		

29.6 : 100 : : 17.8 : .60, the V. S.

The Segment to 60 is .6265, which multiplied by 97.4, the content, the product is 61 gallons, the quantity of liquor in the cask.

By the Sliding Rule.

1st. Set the bung diameter 32 on the line of numbers, to 100 upon the line of Segments; then against the wet inches 19 on the line of numbers is a fourth number 60 on the line of segments, which reserve.

2nd. Set 100 on the line A. to the whole content 97.4 on the line B. and against the reserved number 60 on A. is 61 gallons the answer on B.

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PART VI.

A COLLECTION OF QUESTIONS.

1. WRITE down two millions, five hundred and two thousand, two hundred and five.

2. Find how many years it was from the creation of Adam to the universal deluge in the days of Noah, called Noah's Flood; by the 5th chapter, and 6th verse of the 7th chapter of Genesis. *Ans.* 1656 *years.*

3. When the air presses with its full weight, in very fair weather, it may be demonstrated, that there presses upon a human body about 33905 pounds of that fluid matter; and in foul weather when the air is most light, but 30624 pounds. What difference of weight lies on such a body, in the two greatest alterations of the weather? *Ans.* 3281 *pounds.*

4. Jacob by contract was to serve Laban for his two daughters 14 years; and when he had accomplished 11 years, 11 months, 11 weeks, 11 days, 11 hours, and 11 minutes: Pray how long had he to serve?

Ans. 1*y.* 11*m.* 3*w.* 2*d.* 12*h.* 49*min.*

5. Moses was born Anno Mundi, 2433; Homer 832 after him; Julius Cæsar lived 40 years before our Saviour, and Alexander 312 years before Cæsar; now as Christ was incarnate 4000 years after the creation, the sum of the intervals between Homer and the three great personages last mentioned is required? *Ans.* 1813 *years, sum of the intervals.*

6. From the Creation to the Flood was 1656 years; thence to the building of Solomon's Temple 1336 years; thence to Mahomet, (who lived 622 years after Christ,) 1630 years: In what year of the world was Christ then born?

Ans. Christ was born Anno Mundi, 4000.

7. Part 1500 acres of land, give B. 72 more than A. and C. 112 more than B.

Ans. $\left\{\begin{array}{ll} \textit{acres.} & \\ 413\frac{1}{3} & \text{A's} \\ 486\frac{2}{3} & \text{B's} \\ 598\frac{2}{3} & \text{C's} \end{array}\right\}$ *Share.*

8. The Spectator's club of fat people, tho' it consisted but of 15 persons, is said (No. 9) to weigh no less than 3 tons: How much on an equality was that per man?

Ans. 4 cwt.

9. A. B. and C. found a chest containing a certain number of pounds, and when they divided the booty, A. and B's share amounted to 47*l.* B. and C's to 88*l.* and A. and C's to 71*l.* What sum was found, and each man's share?

Ans. found 103*l.* *A's* 15*l.* *B's* 32*l.* *C's* 56*l.*

10. If the human heart beat 70 times in a minute, and each pulsation transmit 4 oz. Averdupois, of blood, and the whole blood be $\frac{1}{30}$ part of the weight of the body, in what time will the whole blood of a man, whose weight is 140 lb. circulate through the heart? *Ans. in* 34 *sec.*

11. What number added to the 43d part of 4429, will make the sum 240? *Ans.* 137.

12 What number deducted from the 26th part of 2262, will leave the 87th part of the same? *Ans.* 61.

13. What number divided by 419844, will quote 9494, and leave just $\frac{1}{3}$ part of the divisor remaining? *Ans.* 3986138884.

14. Divide $1000 betwixt A. B. and C. in such a manner, that A. may have 129 more than B. and B. 178 less than C.

Ans. $231 B's, 360 A's, 409 C's

15. Required to divide a prize taken at sea, value 203.70*l* 10*s.* 6*d.* among the capt. , 2 lieutenants, the surgeon and purser, 4 petty officers, and 90 private men, allowing each petty officer as much as 2 private men, the surgeon and purser each as much as 8 men, the lieutenants each as much as 16, and the captain as much as 50 men?

Ans. A private man's share 103*l.* 18*s.* 7½*d.*

16. The mean time of a lunation, that is, from new moon to new moon, is 29 days, 12 hours, 44 minutes, and 3 seconds: I demand how many lunations are contained in 19 Julian years, of 365 days, 6 hours?

Ans. 235 *lunations,* 1 *hour,* 28 *m.* 5 *sec.*

17. A. B. and C. play in concert at Hazard; and at making up accounts, it appears, that A. and B. together, brought off 13*l.* 10*s.* B. and C. together 12*l.* 12*s.* and A. and C. together won 11*l.* 16*s.* 6*d.* What did they severally get?

Ans. 5*l.* 9*s.* 3*d.* *A.* 6*l.* 7*s.* 3*d.* *B. and* 7*l.* 2*s.* 9*d.* *C.*

18. Four persons advance in trade, as follows, viz: W. X. and Y. raised 350*l.* 10*s.*; W. X. and Z. 344*l.* 10*s.*; X. Y. and Z, contribute 400*l.*; W. Y. and Z. 378*l.* 4*s.* In the conclusion they parted with their joint property for 450 guineas: What did they gain or loose by their adventure?

Ans. Lost 18*l.* 11*s.* 4*d.* *sterling.*

19. How many trees may be planted on an English acre, at 6 feet distance? *Ans.* 1210.

20. A spring of water, which furnishes 16 gallons each minute, supplies a city of 5000 families. How much water has each family daily? *Ans.* $4\frac{304}{5000}$ gallons.

21. What is the length of a road, which, being 33 feet broad, contains an English acre? *Ans.* 1320 *feet.*

22. If a cow yield 20 quarts of milk in a day for 240 days, and 25 quarts make 1 lb. butter, how many lbs. butter will be obtained in the season, and what does the value come to at $7\frac{1}{2}d.$ per lb? *Ans.* 192 *lb. value* 6*l.*

23. I gave 63 gallons brandy at 7*s.* 4*d.* in barter for 56 gallons rum. What does the rum stand me per gallon? *Ans.* 8*s.* 3*d.*

24. A grocer buys sugar at 3*l.* 15*s.* per cwt. At what rate per cwt. must he sell it, in order to gain 5 per cent. and at what rate per lb. in order to gain 10 per cent? *Ans.* 3*l.* 18*s.* 9*d.* and 8*d.* $3\frac{5}{14}$ *qrs.*

25. Sixteen gallons rum at 7*s.* 6*d.* are mixed with 4 gallons water: what is the value of the mixture? *Ans.* 6*s.*

26. Eighteen gallons rum at 8*s.* are mixed with 14 gallons at 6*s*: what is the value of the mixture? *Ans.* 7*s.* $1\frac{1}{2}d.$

27. The river Po is 1000 feet broad, and 10 feet deep, and it runs at the rate of 4 miles in an hour. In what time will it discharge a cubic mile of water (reckoning 5000 feet to the mile) into the sea? *Ans.* 26 *days* 1 *hour.*

28. If the country which supplies the river Po with water be 380 miles long, and 120 broad, and the whole land upon the surface of the earth be 62,700,000 square miles, and if the quantity of water discharged by the rivers into the sea be every where proportional to the extent of land by which the rivers are supplied; how many times greater than the Po will the whole amount of the rivers be? *Ans.* 1375 *times.*

29. Upon the same supposition, what quantity of water altogether will be discharged by all the rivers into the sea in a year? *Ans.* 19272 *cubical miles.*

30. If the proportion of sea on the surface of the earth to that of land be as $10\frac{1}{2}$ to 5, and the mean depth of the sea be a quarter of a mile; how many years would it take, if the ocean were empty, to fill it by the rivers running at the present rate? *Ans.* 1708 *years.*

31. If 14 men in 15 days build 16 rod of wall,
How many men must added be, to do't in 2 that's all.
Ans. 91.

32. A Father, ignorant in numbers, ordered 500*l.* to be divided amongst his 5 sons, thus, give A. says he, $\frac{1}{5}$, B. $\frac{1}{4}$, C. $\frac{1}{3}$, D. $\frac{1}{6}$, and E. $\frac{1}{7}$; part this equitably among them, according to the father's intention?

Ans.

l.	*s.*	*d.*	*f.*	*rem.*	
152	10	1	1	105	A's
114	7	6	3	423	B's
91	10	0	3	63	C's
76	5	0	2	282	D's
65	7	2	1	45	E's

Shares.

33. If 12 oxen will eat 3⅓ acres of grass in four weeks, and 21 oxen will eat 10 acres in 9 weeks, how many oxen will eat 24 acres in 18 weeks, the grass being allowed to grow uniformly? *Ans.* 36.

34. There is annually consumed in London 98000 black cattle, 600,000 sheep, 180,000 hogs, 16,000,000 lb. butter, and 20,000,000 lb. cheese, and 5,000,000 gallons milk. Required what extent of ground is required to supply it in these articles, supposing 2 acres for rearing, and the produce of of half an acre for fattening each of the cattle; an acre for rearing and fattening 4 sheep; a quarter of grain for fattening each of the hogs, the ground producing at an average, 3½ quarters; three-fourths of an acre for each milch-cow; and that each yields 5 lb. butter, 7 lb. cheese, or 18 gallons milk for 25 weeks? *Ans.* 636475 *acres.*

35. The Chinese wall is 1200 miles long, 18 feet broad, taking one place with another, and of the same height. How many men would it require to build it in 5 years, supposing each to build 2 fathoms in a week? *Ans.* 18635.

36. What difference is there between the interest of 500*l.* at 5 per cent for 12 years, and the discount of the same sum, at the same rate and for the same time?

Ans. 112*l.* 10*s.* *advantage to the interest.*

37. A May-pole 50 feet 11 inches long, at a certain time of the day, will cast a shadow 98 feet 6 inches long: I would hereby find the breadth of a river, that running 20 feet 6 inches from the foot of a steeple, 300 feet 8 inches high, the extremity of the shadow of the steeple reaches 30 feet 9 inches beyond the stream? *Ans.* 530 *ft.* 5 *in. nearly.*

38. If 12 Boarders drink in 7 days half a barrel of beer, how long would the same last if 2 Boarders more came among them? *Ans.* 6 *days.*

39. A. B. and C. make a joint stock: A. puts in 78*l.* B. 117*l.* and C. 234*l.* they gain 265*l*: What is each man's share?

		l.	*s.*	*d.*	*f.*	*rem.*
Ans. gain of	A.	48	3	7	2	234
	B.	72	5	5	1	351
	C.	144	10	10	3	273

40. A. B. and C. make a joint stock: A. puts in 460*l.* B. 110*l.* and C. 480*l.*; they gain 340*l.* What is each partner's share?

		l.	*s.*	*d.*	*f.*	*rem.*
Ans. gain of	A.	107	17	2	3	85
	B.	219	11	8	2	110
	C.	112	11	0	1	95

41. A person was 17 years of age 29 years since, and suppose he will be drowned 23 years hence: Pray in what year of his age will this happen? *Ans.* *In his 69th year.*

42. A certain Island contains 52 counties, every county 42 parishes, every parish 246 houses, and every house 10 persons: I demand the number of parishes, houses, and persons in the Island?

Ans. 2184 *par.* 537264 *houses, and* 5372640 *persons.*

43. What number taken from the square of 54, will leave 19 times 46? *Ans.* 2042.

44. The remainder of a division sum is 649, the quotient 113, the divisor is the sum of both and 24 more: What is the dividend? *Ans.* 89467.

45. The famous Tun of Heidelburgh, that being heretofore annually replenished with rhenish, had in it some wine that was many ages old, before the French demolished it in the late war; it was 31 feet in length, and 21 in diameter, and pretty nearly cylindrical: Pray how many tuns of wine did it contain? Ans. 318 *tuns*, 183.8 *gallons.*

46. Our Satellite, the Moon, is a globe in diameter 2170 miles: I require to know how many quarters of wheat she would contain, if hollow, $2150\frac{2}{5}$ solid inches being the bushel; and how much yard-wide stuff would make her a waistcoat, was she to be cloathed?

Ans. { 7910611528102128540.06 *quarters of wheat.*
45824284391424 *square yards of stuff.*

47. A gentleman hath an annuity of 896*l.* 17*s.* 0*d.* per annum: I desire to know how much he may spend daily, that at the year's end he may lay up 200 guineas, and give to the poor quarterly 10 moidores? *Ans.* 1*l.* 14*s.* 8*d.* 176 *rem.*

48. Three Merchants are in company, their stock is 400*l.* the money of A. continued in 5 months, that of B. 6 months, and C's 9 months, and they gain 375*l.* which they divide equally. I demand the stock each of them put in?

Ans. *A.* $167\frac{9}{43}$*l.* *B.* $139\frac{23}{43}$*l.* *and C.* $93\frac{1}{43}$*l.*

49. If 7 Persons drink 56 gallons of Beer in 12 days, how many gallons will be drank out at that rate in 8 days by 14 persons? *Ans.* 48 *gallons.*

50. If $\frac{3}{4}$ and $\frac{1}{6}$ of the hull of a ship be immersed in the sea, and only 4 feet of it above the surface of the water: What is the depth of the vessel? *Ans.* 48. *ft.*

51. A. put into company 560*l.* for 8 months, B. 279*l.* for 10 months, and C. 735*l.* for 6 months: they gained 1000*l.* What share of the gain must each have?

		l.	*s.*	*d.*	*f.*	*rem.*
Ans.	A.	383	11	2	3	208
	B.	238	17	4	3	80
	C.	377	11	4	1	880

52. A. owes B. 2000*l.* of which 690*l.* are to be paid in 15 months, 350*l.* in 18 months, 710*l.* in 21 months, and the remainder in 24 months: I demand how much ready money he must pay, rebating 8 per cent per annum?

Ans. 1778*l.* 1*s.* $11\frac{5031}{38183}$*d.*

53. The triple, the half, and the fourth of a certain number, are equal to 104: What is the number? *Ans.* $27\frac{11}{13}$

54. A banker at his death, being desirous to reward 10 of clerks, gave orders in his will, that 5500 guineas should be divided among them, in such a manner, that the first 5 should have each an equal share of the whole legacy; that the next 3 should have shared among them one-half of what was bequeathed to the first 5; and that the two last should have divided between them one-third of that sum: What was the share of each?

Ans. Each of the first five to have - 600.
Each of the next three to have 500.
Each of two last to have - - - - 500

55. A. B. and C. make a joint stock of 3256*l.* whereof A. puts in 1026*l.* B. 985*l.* and C. the rest; by misfortune they lose 2000*l.* What part of that must each bear?

		l.	*s.*	*d.*	*rem.*
Ans.	A.	630	4	5	928
	B.	605	0	8½	1240
	C.	864	14	10	1088

56. Four partners, A. B. C. and D. built a ship which cost 1730*l.* and the freight for her first voyage amounted to 370*l.* of which A's share was 74*l.* B's 111*l.* C's 148*l.* and D's 37*l.* What was each partner's stock?

		l.
Ans.	A's stock was	346
	B's – –	519
	C's – –	692
	D's – –	173

57. A. B. C. and D. in partnership, had a joint stock of 600*l.* and gained a certain sum; of which A. B. C. took up 60*l.*; B. C. and D. 90*l.*; A. C. and D. 80*l.*; A. B. and D. 70*l.* What was the stock and gain of each partner?

		stock. *l.*	*gain.* *l.*
Ans.	A's	60	10
	B's	120	20
	C's	180	30
	D's	240	40

58. A Grocer mixeth 36 pounds of tobacco, worth 1*s.* 6*d.* a pound, with 12 pounds of another sort at 2*s.* a pound, and 12

pounds of a third sort at 1*s*. 10*d*. the pound. How may he sell the mixture per pound? Ans. 1*s*. 8*d*.

59. A Grocer would mix three sorts of tobacco together, viz. one sort of 18*d*. per lb. another sort of 22*d*. per lb. and a third sort of 2*s*. per lb. How much of each sort must he take that the whole mixture may be sold for 20*d*. the pound?

Ans. 6 *lb. at* 18*d*. 2 *lb. at* 22*d*. 2 *lb. at* 2*s*.

60. A Vintner bought a pipe of wine at 7*s*. 6*d*. per gallon, with which he mixed a certain quantity of water, and sold the mixture at 10*s*. per gallon, his gain upon the whole was 19*l*. 12*s*. 6*d*. How many gallons of water did he put in?

Ans. 7 gallons 3 quarts water.

61. A boy skaited against the wind 8 miles in an hour and 20 minutes, returning with an uniform stroke, having the advantage of an equal wind, he skaited back the same distance in 32 minutes: Required the force of the wind.

Ans. 396 *feet, per minute.*

62. If a Bath Stone 20 inches long, 15 broad, and 8 inches thick, weighs 220 *lbs*. how many cubic feet thereof will freight a ship of 290 tons burthen? Ans. 4104 feet.

63. A general increases his army one fourth by recruiting, then loses $\frac{1}{10}$ by death, and $\frac{1}{6}$ of the remainder in battle; after which there are 1170 men remaining: How many were there at first? *Ans.* 1248.

64. A captain being asked how many soldiers he had in his company, replied, one half of them are in camp, one third in the trenches, one eight in the hospital, and four in prison: Of how many men did his company consist? *Ans.* 96.

65. A person who had a lease of a house for 99 years, being asked when it would expire, replied, that two-thirds of the time he had possessed it were exactly equal to four-fifths of the time unexpired: How many years of the lease were still remaining? *Ans.* 54.

66. There are two troopers, 25 soldiers, and 18 seamen, who have got a booty of 867*l*. now, according to agreement, one trooper must have as much as two soldiers, and three soldiers as much as 5 seamen: I demand each man's share?

Ans. A trooper 30*l*. *a soldier* 15*l*. *a seaman* 9*l*.

67. A mule and an ass were carrying burdens in company, amounting to some hundred weight. The ass complained of his, and said to the mule, I need only one hundred weight of your load, to make mine twice as heavy as yours. The mule answered, yes, but if you gave me a hundred weight of yours, I should be loaded three times as much as you would be: How many hundred weight did each carry?

Ans. { 2.6 cwt. the Mule's load.
{ 2.2 cwt. the Ass's load.

68. *Three towns, A, B, C, are so situate, that B lies 80*

miles south of A, and C 60 miles west of A: What is the distance between B and C? *Ans.* 100 miles.

68. There are three fields, whereof the first contains 100 acres, 3 roods and 36 poles; the second contains 118 acres, 2 roods and 24 poles; and the third contains 122 acres, 2 roods and 20 poles: Required the side of a square field that shall be equal to all the three in area? *Ans.* 234 poles nearly.

69. How many strokes do the clocks of Venice, (which go on to be 24 o'clock) strike in the compass of a natural day?

Answer, 300.

70. A fir-plant, weight four ounces averdupois, increased to triple weight each year: How much will it weigh at the beginning of the seventh year?

Answer, 182 lb. 4 oz.

71. Suppose one cent had been put out at 6 per cent. per annum, compound interest, at the birth of Christ: What would it have amounted to in 1808 years.

Ans. $57089907708238395242331438777979805455309864$\frac{95}{100}$

72. A stable, 19 feet 6 inches long, and 12 feet 6 inches broad, is to be floored with hard bricks, each 6 inches long, and 3 inches wide: how many bricks will it require?

Ans. 1950.

73. One ev'ning I chanc'd with a Tinker to sit,
Whose tongue ran a great deal too fast for his wit;
He talk'd of his art with abundance of mettle;
So I ask'd him to make me a flat-bottom'd kettle:
Let the top and the bottom diameters be,
In just such proportion as five is to three:
Twelve inches the depth I proposed, and no more;
And to hold in ale gallons seven less than a score.
He promis'd to do it, and straight to work went;
But when he had done it he found it too scant.
He alter'd it then, but too big he had made:
For though it held right, the diameters fail'd it;
Thus making it often too big and too little,
The Tinker at last had quite spoilt his kettle:
But he swears he will bring his said promise to pass,
Or else that he'll spoil every ounce of his brass.
Now, to keep him from ruin, I pray find him out
The diameter's length, for he'll ne'er do it I doubt.

Ans. The bottom diameter is 14.64017, and the top diameter 24.40028.

FINIS.

APPENDIX.

Useful forms in transacting business.

RECEIPT AT THE BOTTOM OF A BILL.

RECEIVED at the same time the contents in full of the above bill. T. W.

RECEIPT FOR RENT.

RECEIVED, Albany, August 1st. 1808, of Mr. John Paywell, the sum of fifty-six dollars and twenty-five cents, in full for a quarters rent due this day. P. V. S.

$56.25.

RECEIPT FOR INTEREST DUE.

RECEIVED, Albany, August 13, 1808, of Mr. A. H. the sum of seventy dollars, in full for one years interest of $1000, due me this day. D. B.

$70.

PROMISSORY NOTE ON DEMAND.

$900.

I Promise to pay C. W. Esq. or order, the sum of nine hundred dollars, on demand, for value received.

Albany, Sept. 28th. 1808. J. K.

PROMISSORY NOTE PAYABLE AT THE BANK.

$722.35. *Albany, October* 13, 1808.

SIXTY days after date, I promise to pay Mr. P. Q. or order at the New-York State Bank, seven hundred and twenty-two dollars and thirty-five cents, for value receiv

M.

INLAND BILL OF EXCHANGE.

£1000. *Albany, September* 29, 1808.

TWENTY days after date, or sight, pay Messrs. R. J. & O. F. or order, one thousand pounds your money, for value received, and place it to account as per advice from,

Messrs. J. & T. H. P. } W. C.
Merchants, Boston. }

FOREIGN BILL OF EXCHANGE.

For 345*l.* 12*s.* sterling. *Albany, October* 13, 1808.

SIXTY days after sight, pay this my first of exchange (second or third of the same tenor and date not paid) to Messrs. D. W. & Co. or order, three hundred and forty-five pounds twelve shillings sterling for value received, and place the same to account as advised by,

Gent.

Your most Humble Servant,

Messrs. Douglas & Shaw, } E——— R———.
Merchants, London. }

OBLIGATION BOND.

KNOW all men, by these presents, that I, G—— C—— of —— in the county of —— am held and firmly bound to E——— B——— of ——— in the penal sum of three hundred dollars to be paid to the said E——— B——— his certain attorney, executors, or administrators; for the payment whereof, I bind myself, my heirs, executors and administrators, firmly by these presents, signed with my hand, and sealed with my seal. Dated at ——— this ——— day of ——— Anno Domini ———.

The condition of this obligation is such, that if the above bounden G——— C——— his heirs, &c. &c. (observe to insert the condition in this place) then this obligation to be void, otherwise to remain in full force and virtue.

Signed, sealed and delivered, } G——— C———
in presence of }
R——— S———
L——— W——— }

A BILL OF SALE.

KNOW all men by these presents, that I, E—— F—— of ——— for and in consideration of ——— to me in hand r[illegible] —— H——— of ——— the receipt whereof I he[illegible]ge, have bargained, sold and delivered,

and, by these presents, do bargain, sell and deliver, unto the said G——— H——— (*Here specify the property sold*) To HAVE and to HOLD the aforesaid bargained premises, unto the said G——— H——— his executors, administrators and assigns, forever. And I, the said E——— F——— for myself, my executors and administrators, shall and will warrant and defend the same against all persons, unto the said G——— H———, his executors, administrators, and assigns, by these presents. In witness whereof, I have hereunto set my hand and seal, this ——— day of ——— 1808.

In presence of

A LEASE OF A HOUSE.

KNOW all men by these presents, that I, E——— F——— of ——— in ——— for and in consideration of the sum of ——— received to my full satisfaction of G——— H——— of ——— this ——— day of ——— in the year of our Lord, 1808, have demised and to farm let, and do, by these presents, demise and to farm let, unto the said G——— H——— his heirs, executors, administrators and assigns, one certain piece of land, lying and being situated in said ——— bounded, &c. (*Here describe the boundaries*) with a dwelling-house thereon standing, for the term of one year from this date. To HAVE and to HOLD to him the said G——— H——— his heirs, executors, administrators and assigns for said term, for him the said G——— H——— to use and occupy, as to him shall seem meet and proper. And the said E——— F——— doth *further covenant* with the said G——— that he hath good right to let and demise, the said letten and demised premises in manner aforesaid, and that he the said E——— during said time will suffer the said G——— quietly to HAVE and to HOLD, use, occupy and enjoy said demised premises, and that said G——— shall have, hold, use, occupy, possess, and enjoy the same, free and clear of all incumbrances, claims, rights and titles whatsoever. In witness whereof, I the said E——— F——— have hereunto set my hand and seal this ——— day of ——— 1808.

Signed, sealed and delivered, in presence of } E——— F———.

A GENERAL LETTER OF ATTORNEY.

KNOW all men by these presents, that I, O——— P——— of ——— have made, ordained, constituted and appointed, and, by these presents, do make, ordain, constitute and appoint, T——— V——— of ——— my true and lawful attorney for me, and in my name, and for my use, to ask, demand

for, recover and receive, of and from all person and persons whatsoever, all sum and sums of money, debts, dues, claims and demands whatever, now due, owing or accruing to me, and to give good and sufficient discharges for the same, and to adjust, settle or compound all debts or demands due to me, and to accept such security or satisfaction for the same as he shall think fit. And I do hereby give and grant to my said attorney, my full and whole power in and concerning the premises, and ratify and confirm whatever he shall lawfully act or do therein. *In witness whereof*, I have hereunto set my hand and seal, the ——— day of ——— A. D. 1808.

Signed, sealed and delivered, in presence of }

A SHORT WILL.

I K—— O—— of &c. do make and ordain this my last will and testament, in manner and form following, viz. I give and bequeath to my dear sister S—— O—— the sum of forty dollars, to buy her mourning. I give and bequeath to my son L—— O—— the sum of six hundred dollars. I give and bequeath to my daughter M—— O—— the sum of five hundred dollars: and to my daughter L—— O—— the like sum of five hundred dollars. All the rest and residue of my estate, goods and chattels, I give and bequeath to my dear beloved wife H—— O——, whom I nominate, constitute and appoint sole executrix of this my last will and testament, hereby revoking all other and former wills by me heretofore made. *In witness whereof*, I have hereunto set my hand and seal, the ——— day of ——— in the year of our Lord ——

Signed, sealed, published and declared, by the said testator, K—— O—— as and for his last will and testament, in the presence of us who have subscribed our names as witnesses thereto, in the presence of the said testator.

C—— F——
A—— S——
K—— P——

Note.—The testator after taking off the seal must in presence of the witnesses pronounce these words; I publish and declare this to be my last will and testament.

Where real estate is devised, three witnesses are absolutely necessary, who must sign it in the presence of the testator.

THE END.